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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-10905# Ministry of Defence, London (England).
TECHNICAL EVALUATION REPORT ON FLUID DYNAMICS PANEL SPECIALISTS' MEETING ON AERODYNAMIC DRAG
S. F. J. Butler Paris AGARD Sep. 1973 14 p refs Conf. held at Izmir, Turkey, 10-13 Apr. 1973
(AGARD-AR-58) Avail: NTIS HC $3.00

The proceedings of a conference on the development of methods for predicting aerodynamic drag are presented. The subjects discussed are: (1) aircraft and wing drag characteristics, (2) helicopter drag, (3) base drag and separation, (4) interaction effects, (5) hypersonic drag, and (7) testing techniques for flight and wind tunnel comparisons. Author

N74-10906# National Aerospace Lab., Amsterdam (Netherlands).
CALCULATION OF INSTATIONARY PRESSURE DISTRIBUTIONS AND GENERALIZED AERODYNAMIC FORCES WITH THE DOUBLET-LATTICE METHOD
R. Roos and R. J. Waan 15 Nov. 1972 39 p refs Sponsored by Directorate of Material Air
(NLR-TR-72037-U) Avail: NTIS HC $4.00

To calculate pressure distributions on configurations consisting of thin wings oscillating harmonically in subsonic flow, the douplet-lattices method was applied and a short outline of the fundamentals of this method given. For a wide range of configurations calculated, results were compared with results of kernel function methods and experimental data. The versatility of the method is demonstrated by the variety of planforms and vibration modes that were used. Some conclusions are made with regard to the number of panels and calculation time. The necessary number of panels varies from 40 for pitching wing configuration to about 150 for T-tail configuration. Calculation times for both doublet-lattice and kernal methods are of the same order. ESRO

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-10907* Lockheed-California Co., Burbank.
MULTISTAGE AEROSPACE CRAFT Patent
Donald Lee Kelly, inventor (to NASA) Issued 16 Oct. 1973 1 p Filed 20 Feb. 1964 Sponsored by NASA
(NASA-Case-XMF-02263; US-Patent-Des-228,688; US-Patent-Appl-SN-78766; US-Patent-Class-D71-1) Avail: US Patent Office CSCL 01C

A conceptual design of a multi-stage aerospace craft is presented. Two perspective views of the vehicle are developed to show the two component configuration with delta wing, four vertical tail surfaces, tricycle landing gear, and two rocket exhaust nozzles at the rear of the fuselage. Engines for propulsion in the atmosphere are mounted on the fuselage in front of the wing root attachment. P.N.F.

N74-10908# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIALISTS MEETING ON HELICOPTER ROTOR PREDICTION METHODS
Aug. 1973 150 p refs Mostly in ENGLISH; partly in FRENCH Conf. held at Milan, 30-31 Mar. 1973
(AGARD-CP-122; AGARD-CP-122) Avail: NTIS HC $9.50

The proceedings of a conference on methods for predicting the dynamic loads on helicopter rotors are presented. The subjects discussed are: (1) rotary wing design technology, (2) rotor system evaluation using helicopter flight simulation program, (3) load prediction methods for hingeless rotor helicopters, and (4) integrated rotor/body loads prediction. For individual titles, see N74-10909 through N74-10916.

N74-10909 Kaman Aerospace Corp., Bloomfield, Conn.
ROTARY WING DESIGN METHODOLOGY
Andrew Z. Lemnios *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 14 p refs (For availability see N74-10908 02-02)

A nonlinear aeroelastic blade loads analysis is described for calculating the coupled responses, airloads distributions, and performance of helicopter rotors. The analysis is divided into two major parts: (1) calculation of blade transient stability behavior by means of linearized, coupled equations of motion; (2) calculation of periodic blade dynamics and airloads distributions using fully coupled, nonlinear equations of motion. The analysis includes six response modes and two input control modes. The equations of motion include all nonlinear inertial coupling effects and nonlinear aerodynamic effects such as reverse flow, Mach number variations, large induced flow angles, unsteady aerodynamics, and variable inflow. Additional features to the analysis are the inclusion of feedback mechanical coupling among the assumed modes and the inclusion of springs and dampers for each mode. Author

N74-10910 Boeing Co., Philadelphia, Pa. Structures Staff.
CURRENT LOADS TECHNOLOGY FOR HELICOPTER ROTORS
Richard Gabel *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 11 p refs (For availability see N74-10908 02-02)

Prediction of fatigue design loads is essential for proper

sizing of helicopter rotor systems. The C-60 rotor loads computer program is discussed. It incorporates the effects of airfoil section geometry, compressibility, stall, three-dimensional flow, unsteady aerodynamics, and nonuniform inflow to provide reliable rotor loads for steady-state flight conditions even into the blade stall region. Rotor loads predictions are compared with actual flight test data from Boeing CH-47 and Model 347 helicopters. An approach to component sizing is presented in which a fatigue design loads histogram is constructed using calculated steady-state flight loads and empirically-determined maneuver loads. Current efforts to improve rotor loads predictions through incorporation of fully coupled lag-pitch-flap routines, simulation of control system dynamics, and development of maneuver loads programs are discussed. Author

N74-10911 Advisory Group for Aerospace Research and Development, Paris (France).
PREDICTION OF HELICOPTER ROTOR LOADS
J. Gallot *In its* Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 8 p refs In FRENCH; ENGLISH summary (For availability see N74-10908 02-02)

The correct design of a rotor requires quite a precise knowledge of the alternating loads to which blade and hub are submitted. The problem of the stress evaluation, from the early design stage, may lead very sophisticated methods, because the blade is operating in a very complex environment. Nevertheless simplified methods may give sufficiently precise results to set up correctly the dimensions of the main elements of the rotor. The method described here supposes simple aerodynamics, independent of blade elastic deformations. The degree of simplification achieved in this theoretical method seems to be justified by the correlation obtained with experimental airloads measured on a model rotor, and stresses recorded on the same rotor or a full-scale semi-articulated rotor. Author

N74-10912 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
HELICOPTER ROTOR LOADS PREDICTIONS
Peter J. Arcidiacono and Raymond G. Carlson *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 12 p refs (For availability see N74-10908 02-02)

A review is presented of the assumptions and techniques forming the basis for detailed computation of rotor loads. Typical correlation results showing the effects of variable inflow and unsteady aerodynamics on blade stresses and control loads are presented. These effects are shown generally to improve the accuracy of predicted results. A discussion of areas where further work can be expected to provide a stronger technical foundation for present analyses is presented. The principal areas include more detailed modeling of (1) the dynamic stall process, (to define unsteady drag, airfoil and blade sweep effects), (2) blade lifting surface effects (to model more accurately blade-vortex interaction effects) and (3) airframe dynamics effects (to define more accurately the dynamic coupling between blade and hub motions). Author

N74-10913 Bell Helicopter Co., Fort Worth, Tex.
ROTOR SYSTEM DESIGN AND EVALUATION USING A GENERAL PURPOSE HELICOPTER FLIGHT SIMULATION PROGRAM
Richard L. Bennett *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 15 p refs (For availability see N74-10908 02-02)

New helicopter rotor systems are designed and existing configurations are evaluated by means of a general purpose helicopter flight simulation computer program. Discussed in this paper are both the analysis incorporated in the program and examples of the results obtained from the program. The three major parts of the analysis are: (1) mathematical model of an elastic rotor based on the modal technique, (2) rotor aerodynamics, and (3) basic rigid vehicle flight mechanics. The interrelationship among these three parts are discussed. The program has been used in support of the following phases of rotor system design and evaluation: (1) rotor blade frequency placement, (2) wind tunnel simulation, (3) steady state flight simulation, and (4) transient or maneuvering flight simulation. Author

N74-10914 Westland Helicopters, Ltd., Yeouil (England).
THE PREDICTION OF LOADING ACTIONS ON HIGH SPEED SEMI-RIGID HELICOPTERS
K. T. McKenzie and D. A. S. Howell *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1973 19 p refs (For availability see N74-10908 02-02)

The analytical techniques employed to predict the primary loading actions of a high speed semi-rigid rotor helicopter are described. The loading actions considered are overall aircraft trim balance, oscillatory rotor loading and vibratory forcing of the airframe. Some of the design considerations associated with each of these loading actions and the correlation with flight test analysis are presented. A description is given of a technique for the analysis of flight test results which has enabled a detailed comparison of the harmonic response of individual modes to be made. Author

N74-10915 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
LOADS PREDICTION METHODS FOR HINGELESS ROTOR HELICOPTERS
G. Reichert *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1972 12 p refs (For availability see N74-10908 02-02)

The special loading condition of the hingeless rotor helicopter is discussed. For the prediction of the loads, the aeroelastic behaviour of the rotor blades including characteristic coupling effects has to be considered. To determine the properties of the hingeless rotor system in an analytical approach, a mathematical model can be used, which simulates the aerodynamic and dynamic behaviour adequately. There is good experience with an aerodynamically and dynamically equivalent system of an articulated rotor with high hinge offset. Analytical data as well as flight test data will be shown for different flight conditions including maneuvers. There is relatively good correlation. The loads necessary for the structural design of the rotor can be predicted reasonably well. The methods are not satisfactory for control loads in stalled conditions and for high harmonic vibratory loads. Author

N74-10916 Army Air Mobility Research and Development Lab., Moffett Field, Calif.
INTEGRATED ROTOR/BODY LOADS PREDICTION
R. M. Carlson and A. W. Kerr (Lockheed-Calif., Burbank) *In* AGARD Specialists Meeting on Helicopter Rotor Prediction Methods Aug. 1972 8 p refs (For availability see N74-10908 02-02)

An interdisciplinary analysis, which has grown out of a requirement for a nonlinear handling qualities evaluation tool, has been mechanized in a fashion which provides a capability to predict rotor loads affected by rotor/airframe interaction in steady-state and transient flight conditions. The modeling philosophy in developing this analysis combines the capabilities of a team of analysts from several specialties to create a versatile model which provides consistent data for numerous applications. This philosophy is presented in addition to a description of the model and a summary of its range of applications. Examples involving rotor loads prediction are presented: (1) evaluation of clearance between rotor blades and fuselage during extreme maneuvers, (2) estimation of four-bladed rotor reactionless implane mode stability and loads, and (3) general maneuver capability and transient loads estimation. Also presented are areas proposed for continued development and refinement of the model to further increase its range of applications. Author

N74-10917*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT NOISE REDUCTION TECHNOLOGY
Mar. 1973 144 p refs
(NASA-TM-X-68241; E-7397) Avail: NTIS HC $9.25 CSCL 20A

Aircraft and airport noise reduction technology programs conducted by NASA are presented. The subjects discussed are: (1) effects of aircraft noise on individuals and communities, (2) status of aircraft source noise technology, (3) operational procedures to reduce the impact of aircraft noise, and (4) NASA relations with military services in aircraft noise problems.

References to more detailed technical literature on the subjects discussed are included. Author

N74-10918*# Scientific Translation Service, Santa Barbara, Calif.
AERODYNAMIC PROBLEMS OF STOL AIRCRAFT
Rene J. Ceresuela Washington NASA Nov. 1973 34 p refs Transl. into ENGLISH from Aeronaut. Astronaut (Paris), no. 41, 1973 p 43-56 Presented at 2d Intern. Student Conf. of the Intern. Astronaut. Congr., Vienna, 10 Oct. 1972
(Contract NASw-2483)
(NASA-TT-F-15182) Avail: NTIS HC $3.75 CSCL 01B

Some of the aerodynamic problems raised by the development of future STOL aircraft are discussed. This discussion emphasizes three characteristic aspects of these aircraft: (1) using the engine air flow to induce most of the lifting forces generated by the wing confers a new severity to the definition of the aircraft behavior in case of engine failure: (2) the important circulation around the wing, the variations in angle of attack and sideslip due to gusts applied at low speed, subject the aircraft lifting surfaces to highly deflected flow configurations, at present very difficult to predict through calculation; this situation justifies its turn the creation of new facilities and calculation methods; and (3) a constraint relative to noise, recently made even more severe, is added to other design constraints to make more complex the economic optimation of projects, by the enforced rejection of solutions that are aerodynamically attractive but are intolerably noisy. Author

N74-10919# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION. ISSUE NO. 1: 1973 ACCIDENTS
10 Aug. 1973 531 p
(NTSB-BA-73-8) Avail: NTIS HC $28.75

Selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1973 are presented. The 899 General Aviation accidents contained in this publication represent a random selection. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N74-10920# Battelle-Northwest, Richland, Wash. Atmospheric Sciences Dept.
METEOROLOGICAL INFORMATION FOR VERTICAL AND SHORT TAKE-OFF AND LAND (V/STOL) OPERATIONS IN BUILT-UP URBAN AREAS: AN ANALYSIS Interim Report
J. V. Ramsdell and D. C. Powell Sep. 1973 243 p refs
(Contract DOT-FA72WAI-263)
(FAA-RD-72-135) Avail: NTIS HC $14.25

An analysis was conducted to identify potential meteorological problems of terminal operations of V/STOL aircraft in built-up urban areas, and to evaluate the adequacy of existing meteorological information to achieve satisfactory development and ensure safe, expeditious operation of a V/STOL transportation system. Existing meteorological information was found inadequate in several respects. To remedy this, a meteorological observation system has been designed for a climatological survey of representative V/STOL port sites in Seattle, Washington. The proposed climatological survey includes meteorological observations at three locations including a typical STOL port site, and elevated VTOL port site and a reference site at the Seattle-Tacoma airport. A technique for estimating wind roses is proposed. The technique involves the use of data collected during the short observation period to modify a wind rose from the closest site having a stable climatology. Author

N74-10921# Lockheed-Georgia Co., Marietta.
V/STOL NOISE PREDICTION AND REDUCTION Final Report, Jun. 1972 - Aug. 1973
Wiley A. Guinn, Dennis F. Blakney, and John S. Gibson Aug. 1973 397 p refs
(Contract DOT-FA72WA-3099)
(LG73ER0062; FAA-RD-73-145) Avail: NTIS HC $22.00

A four phase program of aircraft noise prediction and reduction for V/STOL aircraft is presented. The phases are as follows: (1) identification of noise sources in rotary and jet stream type propulsion systems, (2) definition of noise generating mechanisms for jet stream V/STOL systems, (3) analysis of applicable noise reduction concepts, and (4) numerical analysis and computer programs for predicting far field noise environment of various types of V/STOL aircraft. Author

N74-10922*# Kanner (Leo) Associates, Redwood City, Calif.
VIEWS REGARDING THE VALIDITY OF RESULTS FROM SIMULATION TESTING IN COMPARISON WITH THE RESULTS FROM ACTUAL FLIGHT TEST
U. Schulz and H. Seelmann Washington NASA Nov. 1973 22 p refs Transl. into ENGLISH from "Report on the Third Meeting of the DGLR-Symposium, Flight Testing Technology: Reliability of Results Derived from Simulation in Comparison with Results of actual Flight", West German report DLR-MITT-72-18, Oct. 1- 972 p 29-52 Conf. Held at Bremen, 28 Apr. 1972
(Contract NASw-2481)
(NASA-TT-F-15172) Avail: NTIS HC $3.25 CSCL 01C

A comparison of the validity of results obtained by flight simulation with results obtained from actual flight tests is presented. The background for the development of the simulator is discussed. The techniques for conducting the simulation are outlined. Examples of flight simulation operations are developed. Results of the comparison indicate good correlation between simulation and flight test data. Author

N74-10923*# Kanner (Leo) Associates, Redwood City, Calif.
COMPARISON OF SIMULATION AND FLIGHT TESTING AT AUTOMATIC STOL LANDING
H. Boehret Washington NASA Nov. 1973 21 p Transl. into ENGLISH from "Report on the Third Meeting of the DGLR-Symposium, Flight Testing Technology: Reliability of Results Derived from Simulation in Comparison with Results of Actual Flight", West German report DLR-Mitt-72-18, Oct. 1972 p 7-28 Conf. held at Bremen, 28 Apr. 1972
(Contract NASw-2481)
(NASA-TT-F-15171) Avail: NTIS HC $3.25 CSCL 01C

The comparison of simulation and flight test results for automatic STOL landings is presented. The subjects discussed are: (1) description of flight control system, (2) control of flight path during approach, (3) control of aerodynamic flow conditions, (4) description of simulator, (5) influence of nonlinearity, and (6) application of radar for altitude measurements. Author

N74-10924# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
SERVICE LOADS ON NOSE LANDING GEARS OF THE F-104 AIRPLANE [BETRIEBSKRAEFTE AN BUGFAHRWERKEN DES FLUGZEUGES F-104 G]
O. Buxbaum Dec. 1972 73 p refs In GERMAN Sponsored by Messerschmitt-Boelkow-Blohm G.m.b.H.
(LBF-TB-103/1972) Avail: NTIS HC $5.75

Vertical, lateral and drag loads on nose gears were recorded continuously during 50 flights of two-F-104 G aircraft, and were analyzed statistically. Cumulative frequency and extreme value distributions of the loads in the three axes are presented, as well as information about the correlations between simultaneously occurring load components for the loading conditions, landing, spring-back, taxiing, transition, braking, engine run-up, turning and pivoting. ESRO

N74-10925# Boeing Aerospace Co., Seattle, Wash.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 1: CONFIGURATION DEFINITION (MEDIUM STOL TRANSPORT WITH VECTORED THRUST/MECHANICAL FLAPS) Final Technical Report, 8 Jun. 1971 - 12 Jan. 1973
Richard H. Carroll, John W. Jants, and Peter Milns May 1973 208 p refs
(Contract F33615-71-C-1757; AF Proj. 643A)
(AD-766637; D180-14408-1; AFFDL-TR-73-19-Vol-1) Avail: NTIS CSCL 01/3

A configuration for an Advanced Medium STOL Transport (AMST) using vectored thrust for powered lift is defined in detail. Capability to operate from an austere forward airfield of 2000 feet length at the midpoint of 500 nm radius mission with

28,000 lbs of payload is substantiated by aerodynamic, propulsion, structural, and weights data. The vectored thrust powered lift concept is compared with other powered lift schemes considered for the AMST. A program of continuing research and development in tactical airlift and STOL technology is recommended. Author (GRA)

N74-10926# Boeing Aerospace Co., Seattle, Wash.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 2, PART 1: AERODYNAMIC TECHNOLOGY (DESIGN COMPENDIUM, VECTORED THRUST/MECHANICAL FLAPS) Final Technical Report, 8 Jun. 1971 - 8 Dec. 1972
William J. Runciman, Gary R. Letsinger, Bernard F. Ray, and Fred W. May May 1973 236 p refs
(Contract F33615-71-C-1757; AF Proj. 643A)
(AD-766639; D180-14409-1; AFFDL-TR-73-19-Vol-1-Pt-1) Avail: NTIS CSCL 01/3

The report presents methods for predicting the performance determining aerodynamic characteristics and the stability derivatives of transport-type configurations employing the vectored-thrust mechanical-flap high-lift concept. These methods are suitable for preliminary design. They have been automated in a FORTRAN 4 computer program, for which a users manual and listing are included in this document. Author (GRA)

N74-10927# General Dynamics/Convair, San Diego, Calif.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 1: CONFIGURATION DEFINITION Final Report, 7 Jun. 1971 - 31 Jan. 1973
J. Herbert, Jr., C. A. Whitney, R. E. Johnston, G. B. Nicoloff, E. C. Laudeman, G. F. Campbell, A. Mattia, B. Bracka, W. Service, H. Stocker et al Wright-Patterson AFB, Ohio AFFDL May 1973 158 p refs
(Contract F33615-71-C-1754; AF Proj. 643A)
(AD-766941; GDCA-DHG73-001-Vol-1; AFFDL-TR-73-21-Vol-1) Avail: NTIS CSCL 01/3

The overall objective of the design effort was to conduct a preliminary vehicle-sizing activity to establish baseline configurations for the STOL tactical aircraft investigation. These preliminary baselines were used for the takeoff and landing studies and as a point of departure for wind tunnel test planning and flight control technology activities. The lift/propulsion concepts studied were: Externally Blown Flap (EBF); Mechanical Flap plus Vectored Thrust (MF/VT); and Internally Blown Flap (IBF). The report summarizes the design activities for the three-month and six-month configuration reviews. GRA

N74-10928# General Dynamics/Convair, San Diego, Calif.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 3: PERFORMANCE GROUND RULES AND METHODS. BOOK 1: TAKEOFF AND LANDING GROUND RULES Final Report, 7 Jun. 1971 - 31 Jan. 1973
J. Herbert, Jr., C. A. Whitney, E. C. Laudeman, and G. T. Draper Wright-Patterson AFB, Ohio AFFDL May 1973 55 p refs
(Contract F33615-71-C-1754; AF Proj. 643A)
(AD-766942; GDCA-DHG73-001-Vol-3-1; AFFDL-TR-73-21-Vol-3-1) Avail: NTIS CSCL 01/3

The takeoff and landing performance of tactical STOL transports is entirely dependent on rough field operational capability, ground rules, and specified criteria. A brief study was conducted to assess the impact of stall margins, rolling friction, braking friction, rotation rate, and climb gradient. The STOL handling qualities criteria that provide allowances for the relationship of takeoff and landing distances were briefly investigated. Recommended guidelines, takeoff and landing ground rules, and minimum flying speed are presented. (Modified author abstract) GRA

N74-10929# Whittaker Corp., San Diego, Calif. Research and Development Div.
LOW COST, FIBER GLASS REINFORCED PLASTIC FUEL TANK, VOLUME 1 Final Report, May 1970 - Jun. 1972
Vance A. Chase Apr. 1973 190 p refs
(Contract F33615-70-C-1636)
(AD-766361; AFML-TR-73-26-Vol-1) Avail: NTIS CSCL 01/3

Fiber glass reinforced plastic composite fuel tanks (300 gal.) for the A7D aircraft were developed and tested. The primary objective of this program was to demonstrate feasibility of utilizing fiber reinforced plastic composite materials for fabrication of aircraft tankage on a production basis at low cost. A plywrapping fabrication process in combination with a cost effective design and inexpensive materials selection resulted in a tank considerably lower in cost than the metal equivalent. A cost projection for production quantities of plastic fuel tanks shows a 38% cost saving over metal tanks for a 1200-unit production run. The tank developed utilized woven glass roving and epoxy resin for the main shell and polyester sheet molding compound for the nose and tail cone assemblies. (Modified author abstract) GRA

N74-10930# Naval Aerospace Medical Research Lab., Pensacola, Fla.
ORIENTATION-ERROR ACCIDENTS IN REGULAR ARMY AIRCRAFT DURING FISCAL YEAR 1970: RELATIVE INCIDENCE AND COST
Jorma I. Niven, W. Carroll Hixson, and Emil Spezia 10 Aug. 1973 47 p refs Prepared in cooperation with Army Aeromedical Res. Lab.
(MF51524005)
(AD-767028; NAMRL-1188; USAARL-74-3) Avail: NTIS CSCL 01/2

The report is the fourth in a series of dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1970 include a total of 81 major and minor orientation-error accidents (25 of which were fatal), resulting in 80 fatalities, 104 nonfatal injuries, and an over-all aircraft damage cost of $19,355,689. The contribution of rotary wing accidents to this total was 75 accidents (24 of which were fatal), resulting in 79 fatalities, 98 nonfatal injuries, and over-all aircraft damage cost of $17,060,490. Author (GRA)

N74-10931# Whittaker Corp., San Diego, Calif. Research and Development Div.
LOW COST, FIBER GLASS REINFORCED PLASTIC FUEL TANK, VOLUME 2 Final Technical Report, May 1970 - Jun. 1972
Vance A. Chase Apr. 1973 260 p refs
(Contract F33615-70-C-1636)
(AD-766400; MJO-3019; AFML-TR-73-26-Vol-2) Avail: NTIS CSCL 13/4

Fiber glass reinforced plastic composite fuel tanks (300 gal.) for the A7D aircraft were developed and tested. The primary objective of the program was to demonstrate feasibility of using fiber reinforced plastic composite materials for fabrication of aircraft tankage on a production basis at low cost. The objective was satisfactorily met. Fatigue data for the composite and adhesive bonded materials used in fabrication of the tank was developed. Analysis of the tank involving loads, weight, stress, nesting, and tank volume was performed. Procedure and results of these analyses are reported. Author (GRA)

N74-10932# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A UNIQUE METHOD FOR MONITORING CABIN AIR POLLUTION FROM ENGINE OIL IN THE EB-57 D AIRCRAFT Final Technical Report, Sep. 1968 - Jul. 1970
William J. Crawford and Henry A. Wells May 1973 23 p
(AF Proj. 7360)
(AD-766701; AFML-TR-72-244) Avail: NTIS CSCL 01/3

A simple reliable method for monitoring engine oil pollution in aircraft cabin atmospheres is presented. The method involves use of a specially designed sampling device and a standard quantitative infrared spectroscopic procedure. The report describes the use of this device to evaluate an air decontamination system on the EB-57D aircraft. A catalytic filter has been recommended for use in the EB-57D aircraft to lower the oil content in the cabin atmosphere. Author (GRA)

N74-10933# Whittaker Corp., San Diego, Calif. Research and Development Div.
MANUFACTURING METHODS TECHNOLOGY (MM/T) FOR BALLISTIC-TOLERANT FLIGHT CONTROL COMPONENTS Final Technical Report, Jun. 1971 - Jan. 1973
R. L. VanAuken May 1973 86 p refs
(Contract DAAJ02-71-C-0062; DA Proj. 1F1-62206-A-170)
(AD-766744; MJO-4314; USAAMRDL-TR-73-20) Avail: NTIS

CSCL 01/3

The objective of this program was to develop manufacturing methods and technology for producing glass reinforced plastic, ballistic-tolerant flight control components with a high degree of reliability while using low-cost fabrication techniques. This objective was achieved through development of component designs to obtain simplicity and ease of manufacture. Maximum use was made of commercially available, finished material forms which required a minimum of additional processing. Matched die molding processes were developed which allowed rapid manufacture of parts to final net dimensions. Assembly techniques were developed which used adhesive bonding in precision fixtures and allowed a high degree of reproducibility and reliability of the finished component. (Modified author abstract) GRA

N74-10934# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.

MEASUREMENT OF STRESS STATES IN 20 X 4.4 AIRCRAFT TIRE

Samuel K. Clark, Richard N. Dodge, Donald Lee, and Richard Larson Feb. 1973 57 p refs

(Contract F33615-72-C-1004; AF Proj. 1369)

(AD-766771; Rept-010584-1-T; AFFDL-TR-73-24) Avail: NTIS CSCL 01/3

Measurements were made on the stress state of the tread carcass interface on a 20 x 4.4 Type VII 12 PR aircraft tire operating on curved surfaces simulating a number of different roadwheel diameters. The general results of these measurements show that the stress levels in the tire increase as the roadwheel diameters decrease, using the adjusted pressure schedules given in MIL-T-5041F, and that in all cases the stress levels are higher on curved roadwheels than on a flat surface such as a runway. Author (GRA)

N74-10935# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ESTIMATION OF AN AERONAUTICAL EQUIPMENT MISSION RELIABILITY M.S. Thesis

Robert N. Cockburn May 1973 83 p refs

(AD-766886; GSA/MA/73-1) Avail: NTIS CSCL 01/3

The report develops methods for estimating the probability that an aeronautical equipment will operate satisfactorily for the duration of a specific mission. The failure times are modeled by exponential and Weibull densities. The parameters are estimated from multiple independent grouped and censored samples. Several estimation methods are developed for each model. In addition, the equations to obtain maximum-likelihood estimates are derived. However, they would have to be solved iteratively. Monte Carlo simulation is used to compare estimates with the data grouped and with the failure times known. Author (GRA)

N74-10936# General Dynamics/Convair, San Diego, Calif. Aerospace Div.

STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 3: PERFORMANCE GROUND RULES AND METHODS. BOOK 2: TAKEOFF AND LANDING DIGITAL COMPUTER PROGRAM Final Report, 7 Jun. 1971 - 31 Jan. 1973

J. Hebert, Jr. and C. A. Whitney May 1973 133 p refs

(Contract F33615-71-C-1754; AF Proj. 643A)

(AD-766943; GDCA-DHB73-001-Vol-3-2;

AFFDL-TR-73-21-Vol-3-2) Avail: NTIS CSCL 01/3

The MILSTOL (MILitary STOL) takeoff and landing digital computer program was developed to compute takeoff and landing characteristics of powered-lift STOL aircraft. It calculates a point mass takeoff and/or landing for a trimmed configuration with either externally blown jet flaps, internally blown jet flaps, or mechanical flaps with vectored thrust. Contained in this report are: Discussion of assumptions and methods used in the trajectory calculations; Definition of common list variables; Definition of the input variables and sample input data for the externally blown jet flap configuration; Sample output for the externally blown flap configuration; and Program listings and flow charts. The program is written in FORTRAN IV for use on CDC 6000 series digital computers and requires 37 K sub 8 central memory for loading and execution. GRA

N74-10937# Boeing Aerospace Co., Seattle, Wash.

STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 2, PART 2: A LIFTING LINE ANALYSIS METHOD FOR JET-FLAPPED WINGS Final Technical Report, Jun. 1971 - Mar. 1973

Franklyn J. Davenport Jun. 1973 116 p refs

(Contract F33615-71-C-1757; AF Proj. 643A)

(AD-766877; D180-14409-2-Vol-2-Pt-2;

AFFDL-TR-73-19-Vol-2-Pt-2) Avail: NTIS CSCL 01/3

An analytical procedure is developed for jet flapped wings, in which three-dimensional features of the trailing vortex system are represented. More conservative induced drag is predicted than by analyses based on the traditional planar vortex system. Illustrative examples are given showing that this method gives better agreement with measured drag than the planar-vortex methods. Author (GRA)

N74-10938# Boeing Aerospace Co., Seattle, Wash.

STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 3: TAKEOFF AND LANDING PERFORMANCE GROUND RULES FOR POWERED LIFT STOL TRANSPORT AIRCRAFT Final Technical Report, 8 Jun. - 8 Sep. 1971

Franklyn J. Davenport, Arnold E. Rengstorff, and Vernon F. VanHeyingen May 1973 60 p refs

(Contract F33615-71-C-175; AF Proj. 643A)

(AD-766640; D180-14403-1-Vol-3; AFFDL-TR-73-19-Vol-3)

Avail: NTIS CSCL 01/3

Rules for determining takeoff and landing distances of STOL transport airplanes equipped with powered-lift systems are proposed and discussed. These rules related to speed margins and maneuvering capability required for safe operations and to the procedures for computation of required runway lengths. The most significant difference between the proposed rules and conventional performance rules is that speed margins and maneuvering g - margins should be based on the airplane's capability with power on. Procedures for calculation of powered-lift STOL performance are stated in detail. Author (GRA)

N74-10939# Boeing Aerospace Co., Seattle, Wash.

STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 5, PART 2: FLIGHT CONTROL TECHNOLOGY: PILOTED SIMULATION OF A MEDIUM STOL TRANSPORT WITH VECTORED THRUST MECHANICAL FLAPS Final Technical Report, Jun. 1971 - Dec. 1972

James H. Vincent May 1973 249 p refs

(Contract F33615-71-C-1757)

(AD-766643; D180-14412-2-Vol-5-Pt-2;

AFFDL-TR-73-19-Vol-5-Pt-2) Avail: NTIS CSCL 01/3

Fixed base and piloted simulation studies were conducted to evaluate control systems for a STOL tactical transport equipped with vectored thrust. Unaugmented aircraft flying qualities were found to be unacceptable. However, an augmented control system configuration was found to give excellent flying qualities and satisfactory behavior following engine or control system component failure. The present flying qualities standard for STOL aircraft, MIL-F-83300, was reviewed and several changes are suggested. Author (GRA)

N74-10940# Boeing Aerospace Co., Seattle, Wash.

STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 6: AIR CUSHION LANDING SYSTEM STUDY Final Technical Report, 8 Jun. 1971 - 7 Feb. 1972

Lloyd H. Gardner, Charles J. Pizzichemi, and Peter Milns May 1973 99 p refs

(Contract F33615-61-C-1757)

(AD-766644; D180-14407-1-Vol-6; AFFDL-TR-73-19-Vol-6)

Avail: NTIS CSCL 01/3

Analyses and design studies have been conducted to determine the characteristics of an Air Cushion Landing System (ACLS) as it would be applied to an Advanced Medium STOL Transport (AMST) equipped with mechanical flaps and a vectored thrust powered lift system. It was determined that an ACLS would be feasible on an AMST type airplane, but requires a specia housing arrangement which broadens the ACLS footprint area when it is deployed. Furthermore, special provisions are needed for ground handling and parking. Because it eliminates some of the concentrated loads associated with conventional landing gear, and is easily faired for low drag when retracted, the ACLS would permit a noticeable reduction in aircraft empty weight for a given mission requirement, if structural provisions

for conventional landing gear are not included in the airframe. Substantial uncertainties remain unresolved especially with respect to aircraft/air cushion landing dynamics and spray/debris effects. Author (GRA)

N74-10941# Ohio State Univ. Research Foundation, Columbus.
STUDY OF THE ELECTROSTATIC FIELD AND CHARGE DISTRIBUTION IN A VORTEX SEEDED WITH DUST Interim Technical Report
John W. Daugherty and Henry R. Velkoff Jul. 1973 355 p refs
(Grant DA-31-124-ARO(D)-246; DA Proj. 200-10501-B-700) (AD-766815; AROD-4942-21-E) Avail: NTIS CSCL 01/3

A program was undertaken to investigate the vortex geometry, particle distribution and electric field distribution in a trailing vortex shed from an airfoil tip placed in a dust laden flow. A differential airfoil, positioned in a subsonic wind tunnel, generated the trailing vortex. Dust conditions, typical of a helicopter landing zone, were simulated by seeding the wind tunnel flow with P.V.C. plastic pellets, No. 3 sand, and No. 120 sand. A vaned probe was used to measure the vortex geometry. A particle impact probe and a miniature field meter were used to map the particle distribution and electric field distribution across the trailing vortex. Vortex geometry particle distribution and electric field intensity were measured throughout the plane normal to the wind tunnel axis at several locations downstream from the airfoil. (Modified author abstract) GRA

N74-11680* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODEL STUDIES OF CROSSWIND LANDING-GEAR CONFIGURATIONS FOR STOL AIRCRAFT
Sandy M. Stubbs and Thomas A. Byrdsong *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 145-154 (For availability see N74-11667 02-31)
CSCL 22B

N74-11691* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICOPTER VISUAL AID SYSTEM
Ronald L. Baisley *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 293-309 ref (For availability see N74-11667 02-31)
CSCL 01C

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-10942* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOLID STATE CONTROLLER THREE AXES CONTROLLER Patent
Charles L. Bailey, Jr., inventor (to NASA) Issued 6 Nov. 1973 10 p Filed 15 Mar. 1973 Supersedes N73-20041 (11 - 11, p 1237)
(NASA-Case-MSC-12394-1; US-Patent-3,771,037; US-Patent-Appl-SN-341662; US-Patent-Class-318-580; US-Patent-Class-318-628; US-Patent-Class-244-83) Avail: US Patent Office CSCL 13I

The reported flight controller features a handle grip which is mounted on a longitudinally extending control element. The handle grip is pivotally mounted on the control element about a pitch axis which is perpendicular to the longitudinal axis through the control element. The pivotal mounting includes a resilient force mounting mechanism which centers the grip relative to the control element. Rotation of the handle grip produces a direct rotation of a transducer element in a transducer which provides an electrical indication of the rotative movement about three mutually perpendicular axes.
Official Gazette of the U.S. Patent Office

N74-10943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN, FABRICATION AND CHARACTERISTICS OF NEW TYPES OF BACK SURFACE FIELD CELLS
Joseph Mandelkorn, John H. Lamneck, and Larry R. Scudder 1973 8 p refs Presented at 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; Sponsored by IEEE (NASA-TM-X-71486; E-7814) Avail: NTIS HC $3.00 CSCL 10A

Several new types of back surface field (BSF) cells were designed and fabricated. These include boron and phosphorus diffused BSF cells, single crystal epitaxially grown BSF cells and chemically vapor deposited (CVD) polycrystalline BSF cells. Boron diffusion yielded 10 ohm-cm BSF cells with 0.6 volt open-circuit voltages and collection efficiencies equal to those previously reported for aluminum alloying. The epitaxially grown cells also exhibited high open-circuit voltages and collection efficiencies and may be more radiation damage resistant. The polycrystalline cells had very high internal series resistance. No direct relationship was found to exist between collection efficiency and open-circuit voltage, V sub oc in BSF cells. Results indicate that the V sub oc effect is not caused simply by the mechanism of blocking of minority carriers. Author

N74-10944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE USE OF FEP TEFLON IN SOLAR CELL COVER TECHNOLOGY
Jacob D. Broder and George A. Mazaris 1973 4 p refs Presented at the 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973
(NASA-TM-X-71485; E-7813) Avail: NTIS HC $3.00 CSCL 10B

FEP plastic film was used as a cover and as an adhesive to bond cover glasses to silicon solar cells. Various anti-reflective coatings were applied to cells and subsequently covered with FEP. Short circuit currents were measured before and after application of the coating and of the FEP. FEP was bonded to seven of the nine differently coated cells, with no change in the total short circuit current in four cases. Author

N74-10945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SKYLAB PLUME CONTAMINATION EXPERIMENTS
Robert L. Bowman, Ernie W. Spisz, Ralph D. Sommers, and John R. Jack 1973 15 p refs Presented at 7th Space Simulation, Conf. Los Angeles, 12-14 Nov. 1973; sponsored by AIAA, Am. Soc. for Testing and Mater., and Inst. of Environ. Sci.
(NASA-TM-X-71474; E-7787) Avail: NTIS Hc $3.00 CSCL 10A

The effects of combined exposure to RCS thruster exhaust products and simulated orbital solar radiation were measured on Skylab solar cells, S13G white thermal control coatings, a quartz sample, and a front surface aluminized mirror. A total of 75.5 seconds of exposure to 14 msec pulses from a 5 pound thrust MMH/N204 thruster was achieved. Solar cell maximum power was reduced as much as 10 per cent. The transmittance of the quartz decreased at all wavelengths between 0.2 and 2.5 microns. The most significant transmittance decrease was found at the short wavelengths. For example at 0.2 microns, the contaminated sample transmittance was reduced to zero. The mirror sample also showed a significant decrease in hemispherical reflectance at the short wavelengths. The diffuse reflectance increased at all wavelengths. The S13G white coatings showed large changes in their optical properties. Author

N74-10946*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC VEHICLE BATTERY RESEARCH AND DEVELOPMENT
Harvey J. Schwartz 1973 18 p refs Presented at the Electrochem. Soc. Meeting, Boston, 7-11 Oct. 1973
(NASA-TM-X-71471; E-7772) Avail: NTIS HC $3.00 CSCL 10C

High energy battery technology for electric vehicles is reviewed. The state-of-the-art in conventional batteries, metal-gas batteries, alkali-metal high temperature batteries, and organic electrolyte batteries is reported. G.G.

N74-10947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE MULTIPLE JUNCTION EDGE ILLUMINATED SOLAR CELL
B. I. Sater, H. W. Brandhorst, Jr., T. J. Riley, and R. E. Hart, Jr. 1973 8 p refs Presented at 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; Sponsored by IEEE
(NASA-TM-X-71476; E-7795) Avail: NTIS HC $3.00 CSCL 10B

The multiple junction edge illuminated solar cell was devised for high voltage low current applications. Devices to be flight tested in early 1974 with 96 series connected PNN+ junctions in a 2 cm X 2.3 cm size deliver 36 volts at 1 milliampere. Test data of M-J cells fabricated with resistivities of 10, 50, 100, 200, 450, and 1000 ohm cm silicon are presented and problem areas are discussed. An additional potential application of the M-J cell lies in utilization of its high intensity performance that has been demonstrated at levels in excess of 100 AMO suns.
Author

N74-10948*# Linguistic Systems, Inc., Cambridge, Mass.
INFLUENCE OF WIND FREQUENCY ON ROTATIONAL SPEED ADJUSTMENTS OF WINDMILL GENERATORS
Ulrich Hutter Washington NASA Nov. 1973 17 p Transl. into ENGLISH from Z. Elektrotech. (Stuttgart), v. 1, no. 6, 1948 p 117-122
(Contract NASw-2482)
(NASA-TT-F-15184) Avail: NTIS HC $3.00 CSCL 10A

In installing groups of windmill generators to produce electric power from the force of the wind, it is important to locate the units of such a network in such fashion that the so-called two-minute variation of the wind velocity can be overcome. This is done by using at least three windmill generators located an appropriate distance apart. When the wind velocity is insufficiently great to drive the blades of the windmills, a source of power should be available (battery, power from other windmills) to keep the blades turning. Contrary to popular misconception, changing the angle of attack of the windmill blades does not improve the efficiency of their operation or increase the power of the windmill.
Author

N74-10949# General Electric Co., Philadelphia, Pa. Space Div.
CLOSED CYCLE MHD FOR CENTRAL STATION POWER WITH FOSSIL OR NUCLEAR FUELS
Bert Zauderer, Charles H. Marston, and Charles S. Cook Aug. 1973 48 p refs
(Contract N00014-73-C-0039; AF Proj. 9800)
(AD-766500; Rept-73SD231; ONR-TR-20) Avail: NTIS CSCL 10/2

A closed cycle MHD generator using a noble gas with alkali metal vapor as the working fluid, when used as a topping unit for a conventional steam plant, can yield cycle efficiencies in excess of 60% at peak stagnation temperature of 3000F. While high enough for substantial gains in thermodynamic efficiency, this temperature is relatively low for an electrically conducting gas and conductivity is achieved by decoupling electron temperature from gas temperature. A ceramic regenerative heat exchanger supplies thermal energy to the working fluid. The latter can be any clean fossil fuel, preferably low BTU (about 150 BTU/SCF) coal gas. With multi-stage combustion, pulverized coal is also a possible fuel. On a long range basis, closed cycle MHD is ideally suited for high temperature gas cooled fission reactors and probably also to fusion reactors. The closed cycle MHD generator is adaptable to the Brayton cycle, the regenerative Brayton cycle and eventually the Rankine cycle. Author (GRA)

N74-10950# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF A NON-EQUILIBRIUM MHD GENERATOR Annual Report, 1 Aug. 1972 - 31 Jul. 1973
Bert Zauderer Aug. 1973 34 p refs
(Contract N00014-73-C-0039; NR Proj. 9800)
(AD-766493) Avail: NTIS CSCL 10/2

The report presents research results on the following: The ST-40 MHD channel; The 4 Tesla Magnet for the ST-40 MHD channel; MHD generator theoretical analyses; Gas dynamic performance, ST-40 channel; MHD generator performance, ST-40 channel; Electrode conduction studies. GRA

N74-10951# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Interim Technical Report, Oct. 1972 - Apr. 1973
Alayne A. Adams, Robert T. Foley, and Richard M. Goodman Jun. 1973 59 p refs
(Contract DAAK02-72-C-0084; DA Proj. 1T0-61102-A-34A)
(AD-766329; ITR-3) Avail: NTIS CSCL 10/2

The research on electrochemical energy conversion systems has involved work on two tasks: a search for electrolytes alternative to phosphoric acid for direct and indirect hydrocarbon-air fuel cells, and a study of the corrosion characteristics of electrolytes for intermediate-temperature hydrocarbon-air fuel cells. The work during this reporting period was concentrated on the first task. Two alternative electrolytes, trifluoromethanesulfonic acid monohydrate and dichloroacetic acid, representative of two classes of compounds, were studied in some depth. The first compound shows definite promise as an alternative electrolyte. It is physically and electrochemically stable up to 135C for periods of time up to six weeks. The limiting current density for the oxidation of propane at 135C is approximately 15 times that observed in H3PO4 at the same temperature. Certain problems associated with the use of dichloroacetic acid were encountered. These were interpreted in terms of the state of the unbound water in the electrolyte.
Author (GRA)

N74-10952# Argonne National Lab., Ill.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Annual Report, 1 May 1972 - 1 May 1973
W. E. Amend, R. Cole, J. C. Cutting, and L. C. Pittenger Jun. 1973 79 p refs
(Contracts NAonr-19-72; NAonr-16-73; RF0180206; RR0240302)
(AD-766588; ANL-ENG-73-02) Avail: NTIS CSCL 10/2

Extensive data on the contoured generator has been taken which corroborates the very preliminary data reported previously. Detailed experimental parametric studies were completed which mapped generator performance as a function of mixture quality, magnetic field, and generator loading. Turbine efficiencies of 50% have been achieved for the first-generation contoured generator. The experimental data, coupled with theoretical analyses and modeling, however, has shown conclusively that an electrical shunt exists within the generator. Extensive data has also been taken on the generator with constant cross-sectional inserts; similar results were obtained. Several possible causes for the electrical shunt were identified. In order to identify and isolate the principal electrical shunt, the following steps were taken: The generator was redesigned and rebuilt to completely eliminate leakage and thus the shunt behind the insulator wall; a gas-cleaning system and a micropore NaK filter was installed to minimize the amount of gas impurities that could enter the test facility and remove any oxides as soon as they are formed. These steps were successfully carried out and a new series of performance runs are planned. As the testing proceeds, we will be able to separate the effects of the mechanical and fluid boundary-layer-type shunts. Control of the boundary-layer shunt will be accomplished with a gas injection system. (Modified author abstract) GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-10953 Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, VOLUME 7, NO. 5, 1973
7 Nov. 1973 7 p refs Transl. into ENGLISH of Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 391
(JPRS-60471) HC $9.25

Articles concerning the selection and training of cosmonauts are presented. Data cover: evaluation and analysis of accumulated data to faciliate the on-going transition from orbital to interplanetary flights, research aimed at guaranteeing safety on

long flights and reliability of human component of the man-spaceship system, space psychology and physiology, environmental problems and control (spacecraft habitability, effects radiation and weightlessness) and telemetry. For individual titles, see N74-10954 through N74-10972.

N74-10954 Joint Publications Research Service, Arlington, Va.
DETECTION OF EXTRATERRESTRIAL LIFE FORMS AND CRITERIA FOR THE EXISTENCE OF BIOLOGICAL SYSTEMS
A. B. Rubin *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 1-6 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 3-7 (For availability see N74-10953 02-04)

The general dynamic and energy properties of open systems and their evolution during the course of formation of living systems are reviewed. From this point of view it discusses the criteria for existence and methods for detecting life on other planets which were described in the literature. Author

N74-10955 Joint Publications Research Service, Arlington, Va.
BIOLOGICAL SIMILARITY AND SCALING OF A MODEL OF OXYGEN SUPPLY TO THE CEREBRAL TISSUES OF ANIMALS
V. Sh. Berikashvili, Ye. A. Kovalenko, and A. V. Ryazhskiy *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 7-16 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 7-13 (For availability see N74-10953 02-04)

The use of similarity properties of the main physiological systems of mammals for arriving at numerical laws and their transfer from one group of animals to another is discussed. Equations are derived for assessing the physiological parameters of biologically similar animals. The procedure of calculating models in the form of linear differential equations of a random degree is developed. Possibilities of this procedure are illustrated by calculating a model which shows changes in oxygen pressure in the brain tissues of dogs in relation to variations of oxygen content in the environment. The model is calculated with respect to rats. The modeling results are in good agreement with the experimental findings. This suggests the possibility of generalizing the experimental results and calculating a model for man.
Author

N74-10956 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF RESULTS OF INVESTIGATION OF BIOLOGICAL EFFECT OF HEAVY IONS WITH DIFFERENT LINEAR ENERGY LOSSES ON THE BASIS OF A THEORETICAL INACTIVATION MODEL (THEORETICAL INACTIVATION MODEL)
K. Guenther, Ye. A. Krasavin, Ye. I. Kudryashov, N. I. Ryzhov, and W. Schulz *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 17-24 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 14-20 (For availability see N74-10953 02-04)

It is assumed that cell inactivation is brought about by damage of nuclear DNA which in turn is induced by ionizations occurring in a volume of a known radius containing DNA. On this basis a theoretical model of cell inactivation for ionizing radiations with different linear energy losses was formulated. Using this model, the relationship between the number of single strand and double strand DNA breakages and radiations with linear energy losses differing by a factor of 10,000 is analyzed. Theoretical and experimental results show good agreement. Author

N74-10957 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGICAL REACTIONS IN WHITE RATS DURING READAPTATION AFTER ADAPTION TO HYPOXIC HYPOXIA
V. I. Korolkov, M. S. Gayevskaya, L. V. Serova, Ye. A. Nosova, I. Ya. Lunev, I. I. Britvan, and M. A. Dotsenko *In its* Sapce Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 25-30 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 20-23 (For availability see N74-10953 02-04)

Results of studies of the physiological reactions of white rats during readaptation following their adaptation to hypoxic hypoxia are presented. The experiments were carried out on 120 common male rats weighing 170 to 190 g, the duration of the exposure to hypoxia being 30 days and that of the readaptation period being 30 days. The collected data show that the positive responses of the animal body which developed during stage-by-stage adaptation to hypoxia, such as activation of the erythrocytic system and increased tolerance to acute hypoxia, are transient and disappear a few days after hypoxic training. Author

N74-10958 Joint Publications Research Service, Arlington, Va.
STATE OF NATURAL IMMUNITY OF DOGS EXPOSED TO CHRONIC GAMMA IRRADIATION
V. M. Shilov, S. I. Palmina, and B. A. Markelov *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 31-38 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 23-28 (For availability see N74-10953 02-04)

The results of a study of the natural immunity of dogs which were exposed to three-year chronic gamma irradiation are presented. The relationship between changes in the humoral and cellular factors of natural immunity and the irradiation dose was established. The animals which were irradiated in a dose of 21 rad per year exhibited activation of the complementary and bactericidal properties of the blood. The dogs which were irradiated in doses of 125 rad and 62 + 125 rad per year exhibited changes in immunological reactivity which adhered to certain phases: stimulation was accompanied by a marked decline. These findings give evidence of large compensatory capabilities of the animal body during chronic exposure to ionizing radiation. Author

N74-10959 Joint Publications Research Service, Arlington, Va.
STATE OF SKELETAL BONES IN RATLETS BORN FROM FEMALES EXPOSED TO ROLONGED HYPODYNAMIA
Ye. A. Stroganova and A. I. Volozhin *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 39-44 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 28-32 (For availability see N74-10953 02-04)

Nine male and nine female rats were exposed to 60-day hypokinesia. Eight male and eight female rats which served as controls were kept in normal cages. After the exposure to hypodynamia the test animals were mated simultaneously with the controls. In comparison with the controls the test rats delivered their young later and in a smaller number. These young rats opened their eyes and became hair-covered at a later time. During the first 30 to 40 days their weight and size lagged behind the parameters of the controls. At later stages the difference in these parameters disappeared. During the development test young rats exhibited a higher degree of mineralization and Ca-45 incorporation in bone and tooth tissues. This seems to be a manifestation of compensatory mechanisms aimed at restoration of metabolic processes in calcified tissues during the postembryonal period. Author

N74-10960 Joint Publications Research Service, Arlington, Va.
BLOOD AND TISSUE LIPIDS IN HYPODYNAMIC RATS
T. M. Lobova *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 45-50 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 32-35 (For availability see N74-10953 02-04)

The effect of hypodynamic exposures of different duration on the level of cholesterol, beta-lipoproteins and total lipids in the serum, skeletal muscles, heart, liver, and brain of rats was studied. These investigations revealed that a hypodynamic exposure was followed by an increase in the level of cholesterol and beta-lipoproteins in the serum. The cholesterol content in tissues, especially in the skeletal muscles, increased. The total quantity of lipids in the skeletal muscles, liver, and to a lesser extent, in the heart, decreased. Author

N74-10961 Joint Publications Research Service, Arlington, Va.
FREE AMINO ACIDS IN ANIMAL TISSUES DURING HYPODYNAMIA
I. V. Fedorov *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 51-56 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973

p 35-39 (For availability see N74-10953 02-04)

Experiments on rats revealed that the content of amino acids in tissues changes by the second to third week of hypokinesia: the content of some amino acids increases and that of others decreases. During the eighth to ninth weeks of hypokinesia the content of amino acids and the level of individual amino acids decrease noticeably. Possible effects of these changes on the synthesis of tissue proteins are discussed. Author

N74-10962 Joint Publications Research Service, Arlington, Va.
MOTOR-EVACUATION FUNCTION OF THE GASTROINTESTINAL TRACT IN DOGS DURING PROLONGED HYPODYNAMIA
I. G. Krasnykh and L. A. Tyutin *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 57-64 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 40-45 (For availability see N74-10953 02-04)

The hypodynamic effect of the motor evacuation function in the gastrointestinal tract was studied in dogs. In the first experimental series ten dogs were exposed to 15-day hypokinesia, in the second experimental series 10 dogs were exposed to 30-day hypokinesia; in the third experimental series nine dogs were exposed to 60-day hypokinesia. The hypodynamic effect was brought about by confining the animals in cages of variable volume. The motor-evacuation function in the gastrointestinal tract was investigated by serial radiography. Exposure to 15-day hypokinesia delayed bowel evacuation of these dogs by an average of 1.4 hours (in this case and in all other cases the difference is statistically significant); six of the dogs exhibited pyloric spasms. On the average the bowel evacuation of these dogs ended 30 hours later than prior to exposure to hypodynamia. With an increase in exposure the gastrointestinal changes progressed. Author

N74-10963 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ACCELERATIONS ON ACTIVITY OF THE PROTEIN-SYNTHESIZING SYSTEM AND RNA SYNTHESIS IN THE LIVER OF RATS
O. Yu. Abakumova, N. G. Kutsenko, I. D. Yertanov, Ye. M. Semina, and M. I. Lerman *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 65-74 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 45-51 (For availability see N74-10953 02-04)

Experiments were carried out to study the effect of back-to-chest accelerations of 25 and 36 g applied for six minutes on the activity of the protein-synthesizing system and RNA synthesis in the liver of Wistar rats. This exposure accelerated the incorporation of C-14-amino acids into both polypeptides growing on ribosomes and completed cytoplasmatic proteins. Actinomycin D did not reverse the effect of an increase in the absolute rate of protein synthesis. An exposure to 36-g acceleration increased the absolute rate of albumin synthesis in the liver cells, but did not change the time of its secretion into the blood. Following these exposures, the synthesis of different classes of nuclear and cytoplasmatic RNA in the liver cells increased noticeably. The exposure had no effect on the specific reactivity of the pool of tagged precursors of RNA and protein. Author

N74-10964 Joint Publications Research Service, Arlington, Va.
DEPENDENCE OF REFLEX CIRCULATORY REACTIONS DURING STIMULATION OF THE SINOCAROTID ZONES ON STIMULUS INTENSITY AND TYPE OF ANESTHETIC (EXPERIMENTAL STUDY ON ANIMALS)
B. M. Fedorov and V. A. Kondratyeva *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 75-81 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 51-55 (For availability see N74-10953 02-04)

In acute and chronic experiments on dogs, the stimulation effect, type and depth of anesthesia on cardiovascular reflexes in response to sinocarotid stimulation, as well as the relationship between cardiac and vascular components during pressor reflex in response to carotid artery occlusions were investigated. An increase in arterial pressure during the pressor reflex was dependent primarily on the vascular component. With a low level of dilatation of the carotid arteries, the depressor effect may be completely overlapped by the pressor effect induced by the artery occlusion. Author

N74-10965 Joint Publications Research Service, Arlington, Va.
INDUCED ACTIVITY OF RESPIRATORY CENTER NEURONS ACCOMPANYING STIMULATION OF THE UTRICULAR NERVE AND SPINAL CORD ROOTS
G. S. Ayzikov and L. A. Radkevich *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 82-89 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 55-60 (For availability see N74-10953 02-04)

It is demonstrated that vestibular and muscular afferents for individual respiratory neurons of the medulla oblongata converge. With respect to the latent periods of induced responses, it was established that the relationships between the respiratory center and vestibular and somatic afferents are mostly polysynaptic. The pattern of responses of respiratory neurons was dependent on their functional state. The response of respiratory neurons to somatosensory stimulation was more pronounced than in the case of vestibular stimulation. Author

N74-10966 Joint Publications Research Service, Arlington, Va.
DYNAMICS AND REGULATION OF VENOUS RETURN, MINUTE VOLUME AND STROKE VOLUME WITH A CHANGE IN BODY POSITION
L. I. Kakurin, V. I. Shumakov, V. Ye. Katkov, and A. Ye. Kuvayev *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 90-97 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 60-65 (For availability see N74-10953 02-04)

Hemodynamic changes due to negative and positive gravity loads simulated by positioning of the body at 30 and 80 deg with the head upwards and downwards for five minutes were studied in dogs. A decrease in the hydrostatic pressure in the intrathoracic vessels was found to change circulation and complicate the relationship between venous return, pressure of ventricular filling and stroke volume. Possible mechanisms of regulation of circulation with the head downwards and the head upwards are discussed. Changes in the venous return and stroke volume due to a passive change in body position of man and dogs seem to be parallel. Author

N74-10967 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ANABOLIC STEROIDS ON THE TRANSFER CHARACTERISTICS OF A MAN-OPERATOR UNDER THE INFLUENCE OF INDIVIDUAL SPACEFLIGHT FACTORS
A. K. Sgibnev, V. K. Filosofov, and N. V. Pisarenko *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 98-102 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 65-68 (For availability see N74-10953 02-04)

The anabolic steroid hormone oranobol taken in a dose of 20 mg per day for a period of seven days does not worsen the level of control work and does not influence the state of health and metabolism of a man operator. When studying drug effects on the work quality of a man opertor, a complex signal is used to which adaptation is virtually impossible. Author

N74-10968 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF INCREASED PARTIAL PRESSURE OF OXYGEN ON THE ACID-ALKALI STATE OF THE BLOOD
V. A. Glazkova and I. N. Chernyakov *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 103-110 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 68-73 (For availability see N74-10953 02-04)

Acid-alkali equilibrium was studied in animals and humans by the Astrup-Siegaard-Andersen method. Changes in acid-alkali equilibrium were shown to be dependent on the PO2 in the breathed air and the duration of hyperoxia. The correlation between the acid-alkali equilibrium and morphological changes in the pulmonary tissue induced by hyperoxia suggests that morphological changes may occur and develop in the absence of apparent X-ray shifts. Author

N74-10969 Joint Publications Research Service, Arlington, Va.
ELIMINATION OF TRACE ELEMENTS DURING PROLONGED FEEDING OF MAN WITH DEHYDRATED FOODS
Ye. I. Pokrovskaya, A. P. Tereshchenko, and V. N. Zhurenko *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 111-117 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 73-77 (For availability see N74-10953 02-04)

The content of iron, copper, manganese, zinc, molybdenum, vanadium, cobalt, nickel, lead, tin, chromium and aluminum was measured in five dehydrated diets each providing 3,000 Cal per day. The excretion of these elements was evaluated for the test subjects who were on the diet for a year in a sealed chamber. The excretion of almost all the trace elements revealed a great variability. It was particularly high for urine excretion (20-70%). Variations in the urine excretion of iron, molybdenum, aluminum, lead and chromium were found to reflect changes in their food content. No relationship of this type was established for copper, manganese, vanadium, nickel or tin. Author

N74-10970 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF THE DIURNAL RHYTHM OF PHYSIOLOGICAL FUNCTIONS, PERFORMANCE AND SLEEP IN MAN MODIFIED REGIMES WITH DOUBLE ALTERNATION OF SLEEP AND WAKEFULNESS
A. N. Litsov *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 119-128 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 78-85 (For availability see N74-10953 02-04)

The dynamics of diurnal rhythm of physiological functions, work performance and sleep of test subjects exposed to two schedules with a double alternation of work and rest exhibited the same three stages (latent, apparent and deep) which were observed under other schedules. The adaptation of test subjects to this alternation of sleep and wakefulness may adhere to a fractioned (4 + 4 hours and 6 + 2 hours), displaced (4 + 0.6 + 0 hours) or mixed (fractioned, disturbed and refractioned) schedules. The best schedule was a cycle with 6 + 2 hours of sleep. A schedule with two equal sleep cycles can be used temporarily to solve operational or emergency problems as well as an intermediate one. Author

N74-10971 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE POSSIBILITY OF INCREASING THE NOISE IMMUNITY OF UNIPOLAR CHEST LEADS
R. A. Vartbaronov, L. N. Nikolskiy, and V. I. Polyakov *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 129-135 refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 85-90 (For availability see N74-10953 02-04)

Bioelectric activity measurements of the heart in sport and aerospace medicine and also work physiology are made difficult due to the appearance of different kinds of interference caused by the motor activity of man and other factors. The possibility of increasing noise immunity by placing the neutral electrode in the chest region is reported. Author

N74-10972 Joint Publications Research Service, Arlington, Va.
WORK OF THE AEROSPACE MEDICINE SECTION OF THE MOSCOW PHYSIOLOGICAL SOCIETY IN 1972
Ye. M. Yuganov and V. V. Usachev *In its* Space Biol. and Med., Vol. 7, No. 5, 1973 (JPRS-60471) 7 Nov. 1973 p 136-138 Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 7, no. 5, Sep. - Oct. 1973 p 90-91 (For availability see N74-10953 02-04)

Aerospace medical problems discussed at several conferences covered the principle areas of acceleration and weightlessness, manned space flight hygiene, high altitude physiology, flight psychophysiology, radiobiology, and screening and training of space flight crews. G.G.

N74-10973# Interuniversitair Reactor Instituut, Delft (Netherlands).
HYDROXYPROLINE IN BLOOD AND URINE: INDICATION OF COLLAGEN METABOLISM. - THE DETERMINATION OF D- AND L-C-14 AMINO ACIDS IN THE PRESENCE OF THEIR METABOLITES
C. J. A. VanDenHamer and W. Hart (Utrecht Univ. Hosp.) 1972 16 p refs Submitted for publication
(IRI-133-72-18) Avail: NTIS HC $3.00

The study of hydroxyproline degradation in patients with renal insufficiency was expected to produce parameters for the kidney function. C-14 was measured in blood plasma and urine samples of patients previously injected with a DL-2-C-14-hydroxyproline dose. Since some of the C-14 could be due to metabolites and the ratio D/L hydroxyproline could vary due to different enzymes in the body, a method for determining the hydroxyproline distribution was developed, making use of thin layer chromatography and liquid scintillation counting. The C-14 percentage found for samples previously treated with D-amino acid oxidose (E.C.1.4.3.3) represents the percentage of the L-form only. The results for patients suffering from renal insufficiency, to be published elsewhere, show variable percentages of the D- and L-isomers of hydroxyproline and of C-14 containing metabolites. ESRO

N74-10974# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
ELECTROPHYSIOLOGICAL INVESTIGATIONS ON PITCH ANALYSIS [ELECTROPHYSIOLOGISCHE UNTERSUCHUNGEN ZUR TONHOEHENANALYSE MIT WIEDERHOLUNGSRAUSCHEN ALS SIGNAL]
Georg Boerger and Juergen Gruber 13 Apr. 1972 32 p refs In GERMAN
(Contracts DFG-CR-5/36; DFG-CR-5/44)
(TB-151) Avail: NTIS HC $3.75

Electrophysiological investigations of the acoustic nerve in cats are reported. By formation of the autocorrelation function of action potential (AP) series, its time structure was analyzed. In the case of repetition noise, such as a signal, it was demonstrated that the time parameters in the AP series, functioning as carrier of the pitch information, are present in the single fibers of the acoustic nerve but are not so pronounced as those relating to the resonant frequency of the fibers. The simultaneous leakage of Ap's from several fibers was recorded on magnetic tape. By combination of these AP series in a synopsis model it was possible to isolate the effective time parameters. ESRO

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-10975* Lockheed Missiles and Space Co., Sunnyvale, Calif.
WHOLE BODY MEASUREMENT SYSTEMS Patent
John S. Ogle, inventor (to NASA) Issued 6 Nov. 1973 5 p Filed 18 Nov. 1971 Supersedes N72-20105 (10 - 11, p 1433)
Sponsored by NASA
(NASA-Case-MSC-13972-1; US-Patent-3,769,834;
US-Patent-Appl-SN-200040; US-Patent-Class-73-149;
US-Patent-Class-128-2S) Avail: US Patent Office CSCL 06B

A system for measuring the volume and volume variations of a human body under zero gravity conditions is disclosed. An enclosed chamber having a defined volume and arranged for receiving a human body is provided with means for infrasonically varying the volume of the chamber. The changes in volume produce resultant changes in pressure, and under substantially isentropic conditions, an isentropic relationship permits a determination of gas volume which, in turn, when related to total chamber volume permits a determination of the body volume. By comparison techniques, volume changes of a human independent of gravity conditions can be determined.
Official Gazette of the U.S. Patent Office

N74-10976# Joint Publications Research Service, Arlington, Va.
STRUCTURAL CHANGES IN SPEECH UTTERED IN A HELIUM-OXYGEN MEDIUM
L. S. Butyrskiy and B. I. Petlenko 27 Nov. 1973 14 p refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 19, no. 5,

1973 p 653-661
(JPRS-60633) Avail: NTIS HC $3.00

An evaluation of disturbances is presented for the basic parameters of speech uttered in a helium-oxygen atmosphere at various pressures of the medium. Author

N74-10977# Joint Publications Research Service, Arlington, Va.
AEROSPACE HUMAN FACTORS ENGINEERING
V. G. Denisov and V. F. Onishchenko 31 Oct. 1973 279 p refs Transl. into ENGLISH of the book "Inzhenernaya Psikhologiya v Aviatsii i Kosmonavtike" Moscow, Mashinostr., 1972 316 p
(JPRS-60419) Avail: NTIS HC $16.00

An examination of the problems of the interaction of the operator and machine under different working conditions during a flight on an aircraft or spacecraft is reported. From the standpoint of human factors engineering, the report generalizes and analyzes experimental materials on the control of spacecraft and aircraft. It shows the change in the psychophysiological capabilities of an operator as a result of adapting man to the machine and the machine to man. It also defines the basic theoretical problems in the area of developing and employing man-machine systems on aircraft and spacecraft as well as the ways for solving these problems. Author

N74-10978*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
EFFECTS OF HELICOPTER NOISE AND VIBRATION ON PILOT PERFORMANCE (AS MEASURED IN A FIXED-BASE FLIGHT SIMULATOR)
Allan M. Stave 7 Dec. 1973 89 p refs
(Contract NAS1-11222)
(NASA-CR-132347) Avail: NTIS HC $6.50 CSCL 05E

The effects of noise and vibration on pilot performance are described. Pilot subjects were required to fly VTOL commercial IFR schedules using the computer simulation facilities. The routes flown simulated closely metropolitan routes flown currently by a helicopter airline. The duration of simulator flights ranged from 3 to 8 hours. Subjects were exposed to noise sound pressure levels ranging from 74dB (ambient) to 100dB and 17 Hz vibration stimuli ranging from .1 g to .3 g measured at the floor directly beneath the pilot's seat. Despite subject reports of extreme fatigue in these long flights, performance did not degrade. A curve of performance shows a slow improvement for the first three hours of exposure and a slight loss in performance during the remainder of the flight. As environmental stress conditions (noise, vibration, and time in the simulator) increased, subject performance improved. Within the limits of this study, the higher the stress the better the performance. Author

N74-10979*# National Aeronautics and Space Administration, Washington, D.C.
A BIOLOGIST'S QUESTIONS ON SPACE
A. Burnazyan Nov. 1973 4 p Transl. into ENGLISH from Pravda (Moscow), 9 Nov. 1973 p 3
(NASA-TT-F-15210) Avail: NTIS HC $3.00 CSCL 06B

Biological experiments in space are outlined that consider the effects of weightlessness, penetrating radiation, and their joint results on a variety of biological subjects in order to formulate medicobiological safeguards for long duration manned space flights. A fully automated experiment with animals and biological specimens is being conducted on Cosmos 605 to obtain statistically reliable data about the influence of space flight factors on the structure and functions of the organism. G.G.

N74-10980# Society of Automotive Engineers, Inc., New York.
AN EVALUATION OF PSYCHOACOUSTIC PROCEDURES FOR DETERMINING HUMAN RESPONSE TO AIRCRAFT NOISE. VOLUME 1: SPECIFICATIONS FOR FOUR EXPERIMENTS Final Report
Oct. 1973 65 p
(Contract DOT-FA71WA-2673)
(SAE/R-12-Vol-1; FAA-RD-72-51-Vol-1) Avail: NTIS HC $5.25

Absence of high agreement among laboratory studies involving human response to aircraft noise led to the conclusion that the application of different psychoacoustic procedures could account for differing conclusions. Since there is a continuing requirement to develop an engineering calculation procedure which validly reflects response to flyover noise from future aircraft, a three phase program was conceptualized. That considers detailing of specifications and requirements for four psychoacoustic laboratory experiments plus the acquisition of tape recordings of noises that match the four experiments. The four psychoacoustic laboratory experiments are: Constant Stimulus Difference (Pair Comparison)(CSD); Magnitude Estimation (ME); Numerical Category Scaling (NCS); and Method of Adjustment (MOA). Author

N74-10981# MAN-Acoustics and Noise, Inc., Seattle, Wash.
AN EVALUATION OF PSYCHOACOUSTIC PROCEDURES FOR DETERMINING HUMAN RESPONSE TO AIRCRAFT NOISE. VOLUME 2: DEMONSTRATED EXAMPLES Final Report
J. E. Mabry and H. J. Parry Oct. 1973 82 p Prepared for SAE
(Contract DOT-FA71WA-2673)
(SAE/R-12-2-Vol-2; FAA-RD-72-51-Vol-2) Avail: NTIS HC $6.25

A variety of laboratory procedures have been used to measure human response to aircraft noise during the development of the effective perceived noise level concept. Evaluation of these procedures to determine their effectiveness would be useful in further refinements of EPNL. A project is reported that demonstrates how four of the laboratory methods can be tested and the results used to provide a comparative evaluation. The general conclusion is that experimental plans for four basic psychoacoustic laboratory methods have been demonstrated. Author

N74-10982# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
INVESTIGATION OF BINARY SELECTABLE CONTROL SIGNAL GAIN FOR A TARGET DESIGNATION TASK [UNTERSUCHUNG DER BINAER WAEHLBAREN BEDIEN-SIGNALVERSTAERKUNG BEI EINER POSITIONIERUNG-SAUFGABE]
Guenther Rothbauer, Walter Krueger, and Wolfgang Kruse Oct. 1972 53 p refs In GERMAN; ENGLISH summary
(FB-8) Avail: NTIS HC $4.75; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. 10 DM

A fingerstick with selectability of two different levels of control gain was built to provide the operator simultaneously with the advantages of both high and low control gain in a target designation task. The problems of variable control gain are discussed briefly, and an investigation is reported in which a comparison was made between target designation performance with and without binary selectable control gain in a 0-order system. Two dots or two larger rectangles served as display signals. The performance of 12 subjects indicated that binary selectable control gain improved accuracy and reliability of target designation without markedly affecting the self estimated workload. The dots as display signals were superior to the rectangles with respect to designation error. The selectable control gain is recommended for determining the limit between coarse and fine adjustment in a target designation task. Author (ESRO)

N74-10983# Army Concept Team in Vietnam, San Francisco, Calif. 96384.
ARMY AIRCREW CLOTHING, EQUIPMENT, AND SURVIVAL GEAR
1973 23 p
(AD-766664) Avail: NTIS CSCL 15/5

A proposal was made that all Army aviators be given an initial issue of flight items authorized by TA-21 (Peace), i.e., APH-5 helmet, sun glasses, E-6B computer, etc., upon the successful completion of flight training and rating as an Army aviator by Department of the Army orders. This transaction should be entered on a suitable DA form and made a part of the individual's permanent flight record. The record would show that the equipment has been issued and that the individual is directly responsible and accountable for the property. The equipment would accompany the individual on all transfers. In terms of supply economy there could be substantial savings by adopting this system since, at present, expense is incurred by duplicate or recurring issues. Enlisted aircrew members should continue to draw TA-21 flying equipment through unit supply

channels. A resume of the current status, problem areas, and recommendations for items of aircrew clothing, equipment, and survival gear is given. GRA

N74-10984# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EDUCATIONAL METHODS TEXTBOOKS
G. L. Petrov 31 Jul. 1973 164 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Leningrad), 1966 p 1104
(AD-765580; FTD-MT-24-346-73) Avail: NTIS CSCL 05/9

The training of engineers in welding is achieved in the Soviet Union by following two lines: Equipment and technology, and metallurgy and technology. The Leningrad Polytechnical Institute prepares engineers having a broad background for special training programs. GRA

N74-10985# Boeing Aerospace Co., Seattle, Wash.
ABRASIVE BLASTING RESPIRATORY PROTECTIVE PRACTICES SURVEY Final Report, 29 Jun. 1971 - 31 Aug. 1973
Austin Blair 31 Aug. 1973 126 p refs
(Contract HSM-099-71-47)
(PB-223073/8; NIOSH-TR-048-73; D195-10012-1) Avail: NTIS HC $8.50 CSCL 06I

The abrasive blasting respiratory protective practices survey was conducted using a refined population technique. The results indicate there are approximately one hundred thousand abrasive blasters with personnel exposures to silica dust environments up to sixty million manhours per year. The protection afforded these workmen is, on the average, marginal to poor. Equipment deficiencies and lack of maintenance are the rule rather than the exception. The average sandblaster appeared to have an excellent chance of receiving above TLV quartz exposures and extreme noise exposures. GRA

N74-11398 Hydrometeorological Service of the USSR.
INTERACTION OF MAN AND HIS ENVIRONMENT. PRESENT SITUATION AND PROSPECTS FOR THE FUTURE
Evgeniy Konstantinovich Fedorov *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 115-125 refs (For availability see N74-11381 02-20)

N74-11690* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSDUCER TECHNOLOGY TRANSFER TO BIOENGINEERING APPLICATIONS
E. N. Duran, G. W. Lewis, C. Feldstein, E. Corday (Cedars-Sinai Med. Center), S. Meerbaum (Cedars-Sinai Med. Center), and Tzu-Wang Lang (Cedars-Sinai Med. Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 283-292 refs (For availability see N74-11667 02-31)
(Contracts NAS7-100; HE-14943-01; HL-14644-02)
CSCL 06B

N74-11692* Gyrotrim Corp., Santa Clara, Calif.
A GRAVITY EXERCISE SYSTEM
William E. Brandt and Allen L. Clark *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 311-316 ref (For availability see N74-11667 02-31)
CSCL 06B

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-10986 Utah State Univ., Logan.
ELECTROREFLECTANCE AND CONDUCTANCE MEASUREMENTS IN ELECTROCHEMISTRY Ph.D. Thesis
Wayne Jay Anderson 1973 117 p
Avail: Univ. Microfilms Order No. 73-13288

Reflectance and Conductance measurements were made on thin metallic films used as an electrode in an electrochemical cell to determine if they would provide new information about the electrode interphase. A computer inversion scheme of Fresnel's reflectance equations is used to show that a thin film electrode can be represented by a set of optical constants. A method of measuring the homogeneity and isotropy of a thin film electrode is demonstrated on germanium and gold films. The computer inversion program is used to show that a series of films can be approximated by a one film model for optical calculations. Dissert. Abstr.

N74-10987 Plastimer Usine, Villers Saint Paul (France).
INFLAMMABILITY AND COMBUSTION PHENOMENA IN NON-SATURATED POLYMERS Final Report [ETUDE DES PHENOMENES D'INFLAMMABILITE ET DE COMBUSTION DES POLYESTERS INSATURES RAPPOR]
M. Ochsenbein, A. Zalmanski, L. Kobel, and C. Perros Dec. 1972 26 p refs In FRENCH
(Contract DGRST-71-7-3211)
HC Avail: Issuing Activity

The flammability and combustion phenomena in nonsaturated polyesters are studied with regard to thermal degradation. Methods used were differential thermal analysis, thermogravimetry, isotherm pyrolysis at 650 C with identification of the pyrolysis products and analysis of residues. Two fireproofed polyesters were compared to a classical, propylene-glycol maleophtalate polyester reticulated by styrene. All three polyesters were synthetized. One fireproofing method is performed by C12-P association; another is performed by high C12 content. Three decomposition steps were identified both in air and inert gas atmosphere. The first is without thermal effect, the second leads to a substantial weight loss, and the third depends on the atmosphere. The relative importance of the various steps and activation energies of the decompositions depend on the nature of the polyester. ESRO

N74-10988*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
BINARY CHROMATOGRAPHIC DATA AND ESTIMATION OF ADSORBENT POROSITIES
Arthur J. Meisch Jul. 1972 60 p refs
(Grant NGL-33-018-091)
(NASA-CR-136071; RPI-TR-MP-31) Avail: NTIS HC $5.00 CSCL 07D

Data for the system n-pentane/n-heptane on porous Chromosorb-102 adsorbent were obtained at 150, 175, and 200 C for mixtures containing zero to 100% n-pentane by weight. Prior results showing limitations on superposition of pure component data to predict multicomponent chromatograms were verified. The thermodynamic parameter MRO was found to be a linear function of sample composition. A nonporous adsorbent failed to separate the system because of large input sample dispersions. A proposed automated data processing scheme involving magnetic tape recording of the detector signals and processing by a minicomputer was rejected because of resolution limitations of the available a/d converters. Preliminary data on porosity and pore size distributions of the adsorbents were obtained. Author

N74-10989*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF MOSSBAUER Fe-57 ABSORPTION IN AN F.C.C. Fe-Co-V ALLOY
G. Bambakidis and J. P. Cusick 1973 6 p refs Presented at the 19th Ann. Conf. on Magnetism and Magnetic Mater., Boston, 13-16 Nov. 1973
(NASA-TM-X-71463; E-7759) Avail: NTIS HC $3.00 CSCL 07D

Mossbauer Fe-57 absorption spectra of superparamagnetic F.C.C. Fe sub .34 Co sub .52 V sub 14 (Vicalloy II) have been analyzed using a cluster model and magnetic resonance relaxation theory. The number and magnetic moment of the clusters were determined from magnetization data. A least squares fit to the spectrum at 4.2 K gives sub Hhyp = 175. kG, substantially greater than the value 55 kG inferred just from the observed broadening of the single line spectrum. From this broadening an estimate of 40 kG is obtained for the width of the distribution in Hhyp at 4.2 K arising from compositional fluctuations sub and small cluster effects. Author

N74-10990*# Techtran Corp., Glen Burnie, Md.
DIELECTRIC CONSTANTS AND REFRACTION INDICES OF GASES AS A FUNCTION OF PRESSURE
R. Beaume, R. Nacasch, and R. Coulon Washington NASA Nov. 1973 32 p refs Transl. into ENGLISH from J. Phys. (Paris), v. 26, no. 10, Oct. 1965 p 597-608
(Contract NASw-2485)
(NASA-TT-F-15181) Avail: NTIS HC $3.75 CSCL 07D

Experimental and theoretical techniques are described that are used in the study of the effects of pressure on dielectric constants and refractive indexes varying with the pressure. Variations of the Clausius-Mosotti and Lorentz-Lorenz functions with pressure are observed. For most gases studied both functions show an increase at low density and a decrease at high density. The various results are interpreted by statistical theories. Author

N74-10991*# Morgan State Coll., Baltimore, Md.
PHOTOCHROMISM OF HETEROCYCLIC SYSTEMS Final Report
Ernest F. Silversmith 6 Nov. 1972 1 p
(Grant NGR-21-025-003)
(NASA-CR-136077) Avail: NTIS HC $3.00 CSCL 07C

The preparations of photochromic dimers of a 2-aryl-4,5-diphenylimidazyl radical and of a 2,5-diphenyl-3,4-isobenzopyrrole with different substituents in the homocyclic ring are reported. Of the dienes investigated, only 1-4-diphenyl-1,3-butadiene and 2,3-dimethyl-1,3-butadiene gave isolable amounts of the Diels-Adler adducts. Author

N74-10992*# General Electric Co., Philadelphia, Pa. Space Div.
ANALYSIS OF THE FEASIBILITY OF AN EXPERIMENT TO MEASURE CARBON MONOXIDE IN THE ATMOSPHERE
M. H. Bortner, F. N. Alyea, R. N. Grenda, G. R. Liebling, and G. M. Levy Washington NASA Oct. 1973 262 p refs
(Contract NAS1-10139)
(NASA-CR-2303) Avail: NTIS HC $6.25 CSCL 04A

The feasibility of measuring atmospheric carbon monoxide from a remote platform using the correlation interferometry technique was considered. It has been determined that CO data can be obtained with an accuracy of 10 percent using this technique on the first overtone band of CO at 2.3 mu. That band has been found to be much more suitable than the stronger fundamental band at 4.6 mu. Calculations for both wavelengths are presented which illustrate the effects of atmospheric temperature profiles, inversion layers, ground temperature and emissivity, CO profile, reflectivity, and atmospheric pressure. The applicable radiative transfer theory on which these calculations are based is described together with the principles of the technique. Author

N74-10993# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
REACTIONS OF UREA WITH SEMICARBAZIDE AND SEMICARBAZIDE HYDROCHLORIDE [REAKTIONEN VON HARNSTOFF MIT SEMICARBAZID UND SEMICARBAZIDHYDROCHLORID]
W. Engel 31 Dec. 1972 42 p refs In GERMAN
(ICT-8/72) Avail: NTIS HC $4.25

The reactions of urea with semicarbazide and semicarbazide hydrochloride for differnet molar ratios from 1.1 to 1.2 in fusion and aqueous solutions were investigated. Preliminary tests have shown that by using pure components in the same conditions, biurea was obtained from semicarbazide dissociation and also from semicarbazide hydrochloride in fused aminourazol. Catalytic action on the reactions by nickel and cobalt were studied. ESRO

N74-10994# Interuniversitair Reactor Instituut, Delft (Netherlands).
SZILARD-CHALMERS REACTIONS IN THE HEXAHALO-COMPLEXES OF IRIDIUM. SEPARATION AND IDENTIFICATION OF THE RECOIL PRODUCTS
W. J. VanOoij and J. P. W. Houtman 1973 22 p refs Submitted for publication
(IRI-133-73-03) Avail: NTIS HC $3.25

The Ir-192 labelled products present in aqueous solutions of neutron-irradiated hexahalocomplexes of tri- and tetravalent iridium were separated by high voltage electrophoresis, thin layer electrophoresis, thin layer chromatography and by two dimensional techniques. The intricate mixtures of recoil products were completely resolved and the presence of approximately 35 products could be demonstrated. Author (ESRO)

N74-10995# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
KINETICS OF HYDRAZINE DECOMPOSITION ON IRIDIUM AND ALUMINA SUPPORTED IRIDIUM CATALYSTS Final Report, Jul. 1971 - Jun. 1973
Owen I. Smith and Wayne C. Solomon Aug. 1973 37 p refs
(AF Proj. 573006CH)
(AD-766698; AFRPL-TR-73-59) Avail: NTIS CSCL 07/4

The kinetics of heterogeneous hydrazine decomposition were determined over the temperature range of 460 to 700K for a polycrystalline iridium surface, and the temperature range of 350 to 450K for an alumina supported iridium catalyst. A change in reaction mechanism and/or number of active catalytic sites was observed at approximately 450K for each catalyst. This is attributed to the irreversible, dissociative adsorption of hydrazine on a significant number of catalytic sites below 450K. Catalyst attrition mechanisms in monopropellant hydrazine engines are discussed in the light of this kinetic behavior. Recommendations are made concerning further elucidation of basic processes taking place in monopropellant engine cold starts. Author (GRA)

N74-10996# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
ON DIFFUSION FLAMES IN TURBULENT SHEAR-FLOWS
William B. Bush and Francis E. Fendell Jul. 1973 43 p refs Presented at the 4th Intern. Colloq. on Gas Dynamics of Explosions and Refractive Systems, La Jolla, Calif., 10-13 Jul. 1973 Prepared in cooperation with TRW Systems Group, Redondo Beach, Calif. and Calif. Univ., San Diego, Calif.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. Squid)
(AD-766496; SQUID-TR-TRW-7-PU) Avail: NTIS CSCL 07/1

Predictions of the time-averaged mass fraction profiles for a turbulent diffusion flame, which immediately imply the rate of product formation, are readily made, provided the time-averaged profiles for a passive scalar in the same flowfield and also the probability distribution function for the fluctuating states of the passive scalar in the same flow are known. While recently proposed closures for the time-averaged conservation laws permit the time-averaged profiles to be determined analytically with adequate accuracy, the probability distribution function is likely to require experimental measurement. GRA

N74-10997# Hewlett-Packard Co., Palo Alto, Calif. Solid State Lab.
MAGNETIC RARE EARTH COMPOUNDS 3 Final Technical Report, 14 Jun. 1972 - 14 Jun. 1973
Ronald Hiskes Jul. 1973 82 p refs
(Contract DAAH01-72-C-0996; ARPA Order 1627)
(AD-766331) Avail: NTIS CSCL 07/2

The magnetically uniaxial rare earth iron garnet (Sm,Y)3 (Ga,Fe)5O12 has been grown on (111) Gd3Ga5O12 substrates. The liquid phase epitaxial dipping technique with horizontal substrate rotation has been employed in conjunction with PbO B2O3 and BaO-B2O3 BaF2 solvents in the temperature range of 900C-1030C. Growth parameters in both solvents, such as grown temperature, supercooling, and rotation rate, have been correlated with changes in growth rate and properties of the films. The films have been characterized with respect to composition, impurity content, lattice parameter, optical properties and magnetic properties. Author (GRA)

N74-10998# Berkeley Analytical Sciences Service, Inc., Calif.
IONIZATION DISTRIBUTION OF THE HEAVY IONS Final Report
D. L. Lafferty 30 Jul. 1973 14 p refs
(Contract F44620-70-C-0115)
(AD-766935; AFOSR-73-1651TR) Avail: NTIS CSCL 07/4

The degree of ionization of the heavier ions in a plasma is determined by the opposing effects of ionization and recombination through interaction with the free electrons. A particular heavy

element in the plasma will have a distribution of ionization states determined by the temperature, the electron density, and the atomic structure of the heavy element. For any ionization state the remaining bound electrons can be in various excited states described by the principal quantum number n. The high states are in thermal equilibrium with the free electrons. The populations of the ionization states of the ions limit the transitions to higher states and the continuum is dominated by collisional effects; collisional ionization and three-body recombination. Below the thermal limit the ionizations are still primarily collisional ionizations but the recombinations are primarily by radiative transitions. (Modified author abstract) GRA

N74-10999# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH RESOLUTION LOW TEMPERATURE SPECTRA OF Tb(PLUS 3) IN YA103 M.S. Thesis
Johnny L. Berg Jun. 1973 107 p refs
(AD-766881; GEP/PH/73-3) Avail: NTIS CSCL 07/4

Absorption and emission spectra of terbium-doped yttrium orthoaluminate have been recorded at 77 and 4.2K. Most of the theoretically allowed crystal field levels from 0-37000/cm were identified. A free ion calculation has been carried out. The electrostatic, spin-orbit, and configuration interaction parameters that minimize the mean square deviation between the experimental centers of gravity and the calculated free ion energies were determined. (Modified author abstract) GRA

N74-11631* California Univ., Livermore. Lawrence Livermore Lab.
QUANTUM STATISTICAL MECHANICS OF DENSE PARTIALLY IONIZED HYDROGEN
H. E. Dewitt and F. J. Rogers *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 51-59 refs Sponsored by AEC (For availability see N74-11621 02-30)
(Grant NGL-16-001-043)
Copyright. CSCL 07D

N74-11632* California Univ., Livermore. Lawrence Livermore Lab.
CORRELATION OF THEORY AND EXPERIMENT FOR HIGH-PRESSURE HYDROGEN
William G. Hoover, Marvin Ross, C. F. Bender, Forrest J. Rogers, and R. J. Olness *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 60-64 refs Sponsored by AEC (For availability see N74-11621 02-30)
Copyright. CSCL 07D

N74-11634* Military Academy, West Point, N.Y.
PHASE EQUILIBRIA IN FLUID MIXTURES AT HIGH PRESSURES: THE He-CH4 SYSTEM
W. B. Streett, A. L. Erickson, and J. L. E. Hill *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 69-77 refs Sponsored in part by AROD (For availability see N74-11621 02-30)
(NASA Order W-13142)
Copyright. CSCL 07D

N74-11635* Los Alamos Scientific Lab., N.Mex.
EQUATION OF STATE AND PHASE DIAGRAM OF DENSE HYDROGEN
Gerald I. Kerley *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 78-82 refs (For availability see N74-11621 02-30)
Copyright. CSCL 07D

N74-11647* Rochester Univ., N.Y. Dept. of Geological Sciences.
DISPROPORTIONATION OF Fe2SiO4 TO 2FeO PLUS SiO2 AT PRESSURES UP TO 250kbar AND TEMPERATURES UP TO 3000 C
William A. Bassett and Li-Chung Ming *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 154-160 refs (For availability see N74-11621 02-30)
(Grant NSF GA-25718)
Copyright. CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-11000* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW LOSS DICHROIC PLATE Patent
Richard T. Woo and Arthur C. Ludwig, inventors (to NASA) Issued 30 Oct. 1973 7 p Filed 21 Sep. 1972 Supersedes N73-12150 (11 - 03, p 0266) Sponsored by NASA
(NASA-Case-NPO-13171-1; US-Patent-3,769,623; US-Patent-Appl-SN-290915; US-Patent-Class-343-909; US-Patent-Class-343-781) Avail: US Patent Office CSCL 17B

A low loss dichroic plate is disclosed for passing radiation within a particular frequency band and reflecting radiation outside of that frequency band. The dichroic plate is comprised of a configuration of dipole elements defined by slots formed in a conductive plate. The slots are dimensioned so as to pass radiation of a selected frequency and are shaped so as to minimize the relationship between that frequency and the tilt angle of the plate relative to the direction of radiation. The slots are arranged so as to minimize signal power loss due to cross polarization effects. Official Gazette of the U.S. Patent Office

N74-11001 Pennsylvania Univ., Philadelphia.
RADIO WAVE PROPAGATION IN THE PRESENCE OF AN ELEVATED TROPOSPHERIC DUCT Ph.D. Thesis
Manfred Robert Dresp 1972 144 p
Avail: Univ. Microfilms Order No. 73-13394

An attempt was made to determine the electromagnetic field produced by a vertical magnetic dipole in an inhomogeneous medium above a spherical earth. In particular, the field strength in the presence of an elevated tropospheric duct was determined. The procedure was to reduce the problem to the solution of inhomomeneous Hertzian potential wave equation. The wave equation is solved by separation of variables and the solution is represented as a infinite sum of angular and radial dependent functions. Numerical results are obtained for a trilinear variation of the index of refraction. The solutions are given as a function of frequency, layer height and vertical thickness, the lapse rate of refractive index with height within the layer, and as a function of transmitter and receiver heights and separations. These theoretical results are compared with experimental data obtained in the Atlantic Tradewinds. It is concluded that the extended WKB approach along with the trilinear refractive index model give results that are in good agreement with experiment.
Dissert. Abstr.

N74-11002 Wisconsin Univ., Madison.
A THEORY OF DEPOLARIZATION OF THE RECEIVED SIGNAL ON A TRANS-HORIZON TROPOSCATTER LINK Ph.D. Thesis
John Arthur Wick 1972 132 p
Avail: Univ. Microfilms Order No. 73-2571

A theory of depolarization of the received signal on a trans-horizon troposcatter link is developed. The theory suggests a method of measuring the anisotropy of the turbulent atmospheric scattering layers. The theory also suggests that published measurements of depolarization on trans-horizon troposcatter links may be significantly in error. An analysis of the source of the error in these measurements is indicated in this work. The theoretical basis is laid for a technique of simultaneous channel sounding and data transmission using orthogonal polarizations. The constraints imposed upon this theory by the high resolution of the RAKE tropospheric probing system are explored. The theory of depolarization is developed and it is found that depolarization results from the interaction between the propagating wave front and the refractivity variations in the limited volume of atmospheric turbulence that is responsible for the scattering. Dissert. Abstr.

N74-11003# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

MEASUREMENT OF RF POWER AND ATTENUATION USING SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES Annual Report for FY 1973
R. A. Kamper, M. B. Simmonds, C. A. Hoer, and R. T. Adair Aug. 1973 93 p refs Sponsored in part by DOD Calibration Coordination Group
(CCG Proj. 72-72; NBS Proj. 2750483)
(NBS-TN-643) Avail: SOD HC $1.00 as C13.46:643

The measurement of RF power and attenuation, by the Superconducting Quantum Interference Device (SQUID) is reported. This is a simple circuit of superconducting metal, operating at a very low temperature in a bath of liquid helium. It functions as a sensor of magnetic flux with an almost perfectly periodic response over a wide dynamic range. Author

N74-11004*# Illinois Univ., Urbana. Antenna Lab.
A STUDY OF SELECTED RADIATION AND PROPAGATION PROBLEMS RELATED TO ANTENNAS AND PROBES IN MAGNETO-IONIC MEDIA Final Report
4 Apr. 1973 74 p refs
(Grant NGR-14-005-009)
(SAPR-18; NASA-CR-136009) Avail: NTIS HC $5.75 CSCL 17B

Research consisted of computations toward the solution of the problem of the current distribution on a cylindrical antenna in a magnetoplasma. The case of an antenna parallel to the applied magnetic field was investigated. A systematic method of asymptotic expansion was found which simplifies the solution in the general case by giving the field of a dipole even at relatively short range. Some useful properties of the dispersion surfaces in a lossy medium have also been found. A laboratory experiment was directed toward evaluating nonlinear effects, such as those due to power level, bias voltage and electron heating. The problem of reflection and transmission of waves in an electron heated plasma was treated theoretically. The profile inversion problem has been pursued. Some results are very encouraging, however, the general question of stability of the solution remains unsolved. Author

N74-11005*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTI-MULTIPATH DIGITAL SIGNAL DETECTOR Patent Application
John H. Painter, inventor (to NASA) Filed 2 Nov. 1973 14 p
(NASA-Case-LAR-11379-1; US-Patent-Appl-SN-412379) Avail: NTIS HC $3.00 CSCL 17B

The invention is a detector for radio signals which were transmitted through a multipath medium. The device operates in conjunction with the radio frequency portion of a receiver to detect digital signals which were transmitted in known modulation formats. The transmitted signal is constructed by assigning known and distinct modulation waveforms to a sequence of message symbols, or digits. The basic digital message, which the detector is to reconstruct consists of a sequence of digits, each lasting for a fixed time, say T seconds, and each picked from an alphabet of arbitrary, but fixed, size. For example, in a binary message, the alphabet consists of the digits 0 and 1. In a quartenary message, the alphabet consists of the digits 0, 1, 2, and 3. NASA

N74-11006# Institute for Telecommunication Sciences, Boulder, Colo.
COMPUTER PROGRAMS FOR AIR/GROUND PROPAGATION AND INTERFERENCE ANALYSIS (0.1 TO 20 GHz) Final Report
G. D. Gierhart and M. E. Johnson Sep. 1973 224 p refs
(Contract DOT-FA68WAI-145; FAA Proj. 213-620)
(FAA-RD-73-103) Avail: NTIS HC $13.25

Computer programs for use in predicting the service coverage associated with air/ground radio systems operating in the frequency band from 0.1 to 20 GHz are described Power density, station separation and service volume programs are used to obtain computer-generated microfilm plots. These are: (1) power density available at a particular altitude versus distance from a ground-based transmitting facility; (2) the desired-to-undesired signal ratio, D/U, available at an isotropic receiving antenna versus the distance separating desired and undesired facilities; and (3) constant D/U contours in the altitude versus distance space between the desired and undesired facilities. A discussion of the propagation model involved and program listings are included in the appendices. Author

N74-11007# Carleton Univ., Ottawa (Ontario). Dept. of Systems Engineering.
THE WIRED CITY SIMULATION LABORATORY, PHASE 1
David C. Coll, R. W. McKillican, and P. A. Fried May 1973 129 p refs
(Contract PG.36100-2-0164/OPG-2-0041)
Avail: NTIS HC $8.50

The present status of a laboratory for the simulation wired city systems is reported. This program has as its long term objectives the design and implementation of a flexible laboratory for the testing and evaluation of broadband communications and information services for business, teaching, research, the community, and the home. The laboratory provides multipoint audio, video, and data communications and has the capability for monitoring the communications processes in a variety of ways. Author

N74-11008*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATIVE SIDEBAND AMPLITUDES VERSUS MODULATION INDEX FOR COMMON FUNCTIONS USING FREQUENCY AND PHASE MODULATION
Frank Stocklin Nov. 1973 48 p refs
(NASA-TM-X-70517; X-863-73-112) Avail: NTIS HC $4.50 CSCL 20N

The equations defining the amplitude of sidebands resulting from either frequency modulation or phase modulation by either square wave, sine wave, sawtooth or triangular modulating functions are presented. Spectral photographs and computer generated tables of modulation index vs. relative sideband amplitudes are also included. Author

N74-11009*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INVESTIGATION OF HIGH TEMPERATURE ANTENNAS FOR SPACE SHUTTLE Final Report
E. A. Kuhlman Washington NASA Nov. 1973 149 p refs
(Contract NAS1-11273)
(NASA-CR-2294) Avail: NTIS HC $4.50 CSCL 17B

The design and development of high temperature antennas for the space shuttle orbiter are discussed. The antenna designs were based on three antenna types, an annular slot (L-Band), a linear slot (C-Band), and a horn (C-Band). The design approach was based on combining an RF window, which provides thermal protection, with an off-the-shelf antenna. Available antenna window materials were reviewed and compared, and the materials most compatible with the design requirements were selected. Two antenna window design approaches were considered: one employed a high temperature dielectric material and a low density insulation material, and the other an insulation material usable for the orbiter thermal protection system. Preliminary designs were formulated and integrated into the orbiter structure. Simple electrical models, with a series of window configurations, were constructed and tested. The results of tests and analyses for the final antenna system designs are given and show that high temperature antenna systems consisting of off-the-shelf antennas thermally protected by RF windows can be designed for the Space Shuttle Orbiter. Author

N74-11010# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
PICTURE PROCESSING AND INTERACTIVE SYSTEMS. PART 1: PICTURE PROCESSING [SYMPOSIUM BILDVERARBEITUNG UND INTERAKTIVE SYSTEME. TEIL 1: BILDVERARBEITUNG]
Porz, West Ger. 2 Jan. 1973 135 p refs Partly in GERMAN and partly in ENGLISH css Inst. fuer Satellitenelektronik. Proc. of the DFVLR Symp., Oberpfaffenhofen, West Ger., 10 Dec. 1971
(DLR-MITT-73-11) Avail: NTIS HC $8.75; DFVLR, Porz, West Ger. 41,40 DM

Topics in the field of optical data processing are presented. The operating principle and the implementation of an adaption coder for television signals are described along with two techniques

for inverse filtering of linear shift-variant imaging systems. The efficiency of facsimile transmission for polyomino filtering at the receiver was investigated. Examples and possibilities of optical data processing applications to the qualitative classification and quantitative evaluation of images of macroscopic and microscopic objects are discussed. Examples of the simulation of picture transmission systems on a digital computer are included. For individual titles, see N74-11011 through N74-11015.

N74-11011 AEG-Telefunken, Ulm (West Germany). Forschungslaboratorium.
AN ADAPTIVE SOURCE CODER FOR TELEVISION SIGNALS
B. Wendland and F. May *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2 Jan. 1973 p 9-19 (For availability see N74-11010 02-07)

The operating principle and the implementation of an adaptive coder for television signals are described. The coder makes use of the intra-frame dependencies similar to differential pulse code modulation with nonlinear quantization. Signals are adaptively selected and properly coded which represent the most significant part of the source information. ESRO

N74-11012 Bell Telephone Labs., Inc., Whippany, N.J.
INVERSE FILTERING FOR LINEAR SHIFT-VARIANT IMAGING SYSTEMS
G. M. Robbins and T. S. Huang (Eidgenoess. Tech. Hochschule Zurich) *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2 Jan. 1973 p 20-79 refs (For availability see N74-11010 02-07)

Two techniques are described for inverse filtering of linear shift-variant imaging systems. The first technique requires that the linear system be decomposed into a distortion of the input plane followed by a shift-invariant operation and terminated by a distortion of the output plane. The second technique relies upon the assumption that the system may be specified by several shift-invariant impulse responses. It is shown that such systems may be inverted by the same techniques used to invert the Wiener-Hopf integral equation. Computer generated examples of the first technique are presented. Author (ESRO)

N74-11013 International Business Machines Corp., Zurich (Switzerland). Research Lab.
DIGITAL COMPUTER SIMULATION OF PICTURE TRANSMISSION SYSTEMS [SIMULATIONV ON BILDUEBERTRAGUNGS-SYSTEMEN AUF DEM DIGITALRECHNER]
P. Stucki *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2 Jan. 1973 p 80-103 ref In GERMAN Submitted for publication (For availability see N74-11010 02-07)

Some examples of computerized simulation of picture transmission systems are presented. The systems investigated were: address-coded multiplex transmission of black and white pictures, PCM and DPCM picture transmission. It is shown that comprehension system investigations can be carried out, and the use of the digital computer for rational systems developmental work is demonstrated. ESRO

N74-11014 International Business Machines Corp., Zurich (Switzerland). Research Lab.
EFFICIENT TRANSMISSION OF GRAPHICS USING POLYOMINO FILTERING AT THE RECEIVER
Peter Stucki *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2 Jan. 1973 p 104-115 refs Submitted for publication (For availability see N74-11010 02-07)

A simple new coding scheme was developed which increases the transmission efficiency for graphics by a factor of 2, and can transmit two documents over the initial channel used to transmit a single picture, while preserving the picture quality. Based on the exploration of polyominoes, the initial message is submitted to a well-defined information extraction process at the transmitterr, and a corresponding reconstruction manipulation for message display at the receiver. Author (ESRO)

N74-11015 Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany).
SOME EXAMPLES OF QUANTITATIVE PICTURE PROCESSING FOR PHYSICAL, BIOLOGICAL, AND MEDICAL INTERROGATORIES [EINIGE BEISPIELE DER QUANTITATIVEN BILDVERARBEITUNG BEI PHYSIKALISCHEN, BIOLOGISCHEN UND MEDIZINISCHEN FRAGESTELLUNGEN] c14
W. Abmayr *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2 Jan. 1973 p 116-134 refs In GERMAN (For availability see N74-11010 02-07)

Examples, and possibilities of optical data processing application in the qualitative classification and the quantitative image evaluation of macroscopic and microscopic objects are discussed. Use was made of a flying spot scanner in on-line combinations with a digital computer. The examples discussed are: quantitative processing of detectors for nonphotographic particle track recording, measurement of population growth of yeast cells, and quantitative evaluation of autoradiograms. ESRO

N74-11016# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
SELECTION OF DIRECT TRANSMISSION TV SATELLITE SYSTEMS TAKING ACCOUNT OF DIRECTIONAL REQUIREMENTS [SYSTEMAUSWAHL DIREKTSENDENDER FERNSEHSATELLITEN UNTER DEM GESICHTPUNKT DER HOHEN AUSRICHTANFORDERUNGEN]
K. Kaeselau 1973 26 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973 (DGLR-Paper-73-047) Avail: NTIS HC $3.50

The criteria for evaluation of direct broadcasting TV satellites are reviewed in regard to high alignment requirements. The alignment tolerances are defined, and possible reference and attitude control systems are described. Available solar arrays and other components are surveyed. The possibility of using ion engines for inclination correction is mentioned. ESRO

N74-11017# AEG-Telefunken, Backnang (West Germany).
COMMUNICATION ENGINEERING EQUIPMENT FOR TELEVISION BROADCASTING SATELLITES [NACHRICHTENTECHNISCHE EINRICHTUNGEN VON FERNSEHRUNDFUNK-SATELLITEN]
K. Seidensticker 1973 13 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973 (DGLR-Paper-73-053) Avail: NTIS HC $3.00

The functioning and some critical design points of direct TV broadcasting satellite transponders are reviewed. The contribution to signal noise should be as small as possible, which leads to tight specification of the preamplifier. The advantages of intermediate frequency conversion are summed up. Among the critical design problems discussed, one of the main points is the influence of differential distrotions on FM television signals. ESRO

N74-11018# Standard Electrik Lorenz A.G., Stuttgart (West Germany).
AEROSAT AND MARSAT: SATELLITES FOR MOBILE SERVICES [AEROSAT UND MARSAT, SATELLITEN FUER MOBILE DIENSTE]
H. C. Freiesleben and H. J. Wollak 1973 10 p refs In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973
Avail: NTIS HC $3.00

The Aerosat and Marsat communication satellite projects for air traffic control and ship navigation are discussed. Some of the problems reviewed are: frequency assignment, antennas for aircraft and ships, type of modulation, satellite multiple access techniques, transponders, and multipath propagation. ESRO

N74-11019# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
SIMULATION OF DIFFERENTIAL PCM SYSTEMS FOR SPEECH CODING [SIMULATION VON DIFFERENZ-PCM-SYSTEMEN ZUR SPRACHCODIERUNG]
Peter Noll and Bolf Block 22 Mar. 1972 47 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft (TB-150) Avail: NTIS HC $4.50

The usefulness of the differential PCM (DPCM) method for the encoding of speech signals was investigated by means of computerized simulation. The results are presented and compared with theoretical results. It is shown how the linear relationship between the sampled values of speech signals can be practically

eliminated by means of DPCM. The information containing part can then be described more accurately for the same transmission rate, so that the quantization noise is reduced as compared to PCM. Redundant parts, determined by relations with higher statistical order, can be processed and eliminated by a nonlinear encoding device. ESRO

N74-11020# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
INVESTIGATIONS ON THE QUANTIZATION OF GAUSSIAN SOURCES WITHOUT MEMORY [UNTERSUCHUNGEN ZUR QUANTISIERUNG GEDAECHTNISFREIER GAUSSQUELLEN]
Rainer Zelinski and Peter Noll 19 Dec. 1972 110 p refs In GERMAN
(TB-159) Avail: NTIS HC $7.50

Errors in quantization depend on the type of quantization characteristic involved. Several optimization criteria were investigated. It is shown that optimal quantizers, such as the quantizer for the smallest mean quadratic error and the quantizer for maximal information flow, can be derived from a more general optimal quantizer. The investigations cover linear as well as nonlinear quantizer characteristics and also deal with entropy encoding. The evidence obtained is based on calculations, iterative optimization methods, and results of simulations with Gauss distributed sampling values. The results are compared with the rate distortion function for memory-less Gauss sources. ESRO

N74-11021# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
DECODER FOR ONE-STEP CHAIN CODES [EIN DECODER FUER EINSCHRITTIGE KETTENCODES]
Klaus Boettcher 20 Dec. 1972 17 p refs In GERMAN
(TB-160) Avail: NTIS HC $3.00

A decoder is described for a PCM receiver. The transmission code of the PCM system is a one-step chain code which allows for correction of single errors. A detailed description of the decoder is given; it consists of error detecting and error correcting points. A description is also given of the digital to analog converter employed, taking into account the expanding function. ESRO

N74-11022# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
PROBABILITY DENSITY APPROXIMATION USING MOMENTS FOR CHARACTER RECOGNITION AND PROCESS DESCRIPTION [WAHRSCHEINLICHKEITSDICHTE-APPROXIMATION MITHILFE VON MOMETEN ZUR ZEICHEN-ERKENNUNG UND PROZESSBESCHREIBUNG]
Hans Dietrich Hoehne 1973 161 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(TB-163) Avail: NTIS HC $10.25

An adaptive moment method was developed for probability density approximation. Possible applications include process description and character recognition. Since it is a moment method, no single value storage is necessary. Equivalence classes are formed represented by normal distributions. Every equivalence class is allocated a set of moments. During data reception the characters received are classified by variation of the set of moments. During blockwise processing, a test is performed on the sets allocated to every class to determine wheather classes are to be dissected or combined with neighboring classes. In this way, the number of classes and the class boundaries can be determined during data reception. If no sufficient data are available, the same data block can be read several times. A modification of the method for the approximation of mixed distributions, in which frequencies with classes are available, is also presented. ESRO

N74-11023# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
SPEECH TRANSMISSION USING ADAPTIVE DIFFERENTIAL PCM METHODS [SPRACHUEBERTRAGUNG MIT ADAPTIVEN DIFFERENZ-PCM-VERFAHREN]
Peter Noll 25 May 1973 96 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(TB-164) Avail: NTIS HC $7.00

The redundancy of speech signals can be eliminated by differential PCM methods, the residual relevent part can then be transmitted digitally at a reduced bit rate. It is shown which bit rate reduction can be obtained by adaptive methods, in which the coder adapts itself to the variations of the statistical characteristics of speech signals. Several interesting algorithms are compared, keeping in mind hardware realization. The investigations point out that it is possible to save 3 to 4 bits in the digitalization of each sampled value of the speech signal. In this way, the number of voice channels over PCM links can be nearly doubled. ESRO

N74-11024# Army Missile Command, Redstone Arsenal, Ala.
RECURSIVE DIGITAL FILTER DESIGN AND ANALYSIS WITH APPLICATIONS TO RADAR PROCESSING
Robert H. Fletcher, Jr. 30 Apr. 1973 96 p refs
(DA Proj. 1M2-62303-A-002)
(AD-766689) Avail: NTIS CSCL 09/5

The design and analysis of recursive digital filters by use of the bilinear z-transformation are presented for Butterworth and Chebyshev Type I filters. Although the motivation and primary emphasis of this work lies in the area of radar moving-band-stop filtering as well. The design and analysis of these filters are accomplished with the aid of a set of FORTRAN subroutines which are described and listed here. Examples illustrating the use of these subroutines and some typical results are included.
Author (GRA)

N74-11025# Stanford Research Inst., Menlo Park, Calif.
CELLULAR LOGIC-IN-MEMORY ARRAYS Progress Report, 1 Jun. 1972 - 31 Jul. 1973
Marshall C. Pease 29 Aug. 1973 28 p refs
(Contract N00014-72-C-0431)
(AD-766471; PR-1) Avail: NTIS CSCL 17/9

Work is directed towards the evaluation of the system design being developed by the Naval Laboratory for the All Applications Digital Computer (AADC). The work has sought to determine the applicability of the system for the on-line processing of signals from a high-performance intermediate-range radar system. The study included consideration of the Signal Processing Element (SPE), its component Signal Processing Arithmetic Units (SPAU), and the Microprogrammed Control Unit (MCU) as currently developed. Where the current design was found to be inadequate for the task, modifications to the design were sought which would realize the required performance. Details of the analysis are given in the Appendix. The general conclusion is that a single SPAU, as currently designed, would require a speed up by a factor of approximately 8 to meet the application envisioned. A modification to the system concept is proposed to permit the use of up to 8 SPAUs in parallel in such an application. GRA

N74-11026# Mitre Corp., Bedford, Mass.
THE OPTIMUM RECEIVER STRUCTURE AND PERFORMANCE OF A MANCHESTER-CODED FSK DATA LINK
J. W. Martin Jun. 1973 47 p refs
(Contract F19628-73-C-0001; AF Proj. 8330)
(AD-766651; MTR-2518; ESD-TR-73-127) Avail: NTIS CSCL 17/2

A receiver structure is developed for detection of Manchester-coded (split-phase) FSK data. Such a signaling format is used for the sensor-relay platform link associated with Ground-Based Sensors, Project 8330. The receiver structure is optimum in the sense that it is the structure that minimizes the bit error rate for a given transmitted signal energy. The performance (BER) of the receiver is determined, and a comparison is made to the performance of the present receiver used in the Ground-Based Sensor System. It is shown that the optimum receiver requires 9.3-dB less signal energy to establish an equivalent BER. Conversely, for equal signal energy transmissions the optimum receiver would allow for adequate operation in a more severe jamming environment. Author (GRA)

N74-11027# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE PROPAGATION OF MICROWAVES: A REVIEW WITH APPLICATIONS TO RADIO-FREQUENCY INTERFERENCE BETWEEN RADARS
J. J. Gerald McCue 16 Mar. 1973 57 p refs
(Contract F19628-73-C-0002; DA Proj. 7X2-63304-D-215)
(AD-766560; ESD-TR-73-77; TR-500) Avail: NTIS CSCL 20/14

The report, offered as a help to designers of radar systems, reviews microwave propagation over smooth earth, over man-made barriers such as fences for reducing radio-frequency interference, and over rough terrain. Particular attention is paid to various aspects of diffraction and to scattering by rain.
Author (GRA)

N74-11028# Lockheed Missiles and Space Co., Palo Alto, Calif.
IONOSPHERIC DISTURBANCES AFFECTING RADIO-WAVE PROPAGATION Final Report, May 1972 - Jun. 1973
John B. Cladis, Gerald T. Davidson, William E. Francis, Lester L. Newkirk, and Martin Walt Aug. 1973 89 p refs
(Contract DNA001-72-C-0178)
(AD-766541; LMSC-D315887; DNA-3103F) Avail: NTIS CSCL 20/14

The problem of radar propagation through an ionosphere disturbed by a nuclear detonation is reviewed, and various theories which have been proposed to explain the naturally occurring ionospheric disturbances are discussed. It is indicated that, although the ionospheric irregularities occurring near the equator are now fairly well understood, much more experimental and theoretical work is needed before we can understand the considerably more complicated processes occurring in the high-lattitude regions. An investigation is described to test whether the theory contained in the computer program AURORA includes all important processes required to calculate the correct rate at which energy is deposited in the atmosphere by precipitating auroral electrons. A new process is proposed to explain the high fluxes of energetic O(-) ions observed during the magnetic storm of 17 December 1971. (Modified author abstract) GRA

N74-11029# Signatron, Inc., Lexington, Mass.
NONLINEAR SYSTEM MODELING AND ANALYSIS WITH APPLICATIONS TO COMMUNICATIONS RECEIVERS Interim Report, Apr. 1970 - Sep. 1972
James W. Graham and Leonard Ehrman Jun. 1973 749 p refs
(Contract F30602-70-C-0008)
(AD-766278; RADC-TR-73-178) Avail: NTIS CSCL 17/2

The objective was to develop reliable, realistic, and useful mathematical models of communication receivers that must operate in the presence of interfering signals. Major emphasis was placed upon understanding basic pehnomena and developing techniques needed to provide a capability of modeling receiver structures for multi-signal inputs. During the study considerable effort was placed upon modeling so that the effects of co-channel and adjacent channel interfering signals having arbitrary modulations in the presence of receiver nonlinearities might be effectively investigated. Therefore, methods of investigating quasi-linear systems having significant frequency selectivity were developed. Matters relating to intermodulation and crossmodulation distortion as well as gain compression, desensitization, and dynamic range were of primary concern. Associated with these developments was a companion effort to develop effective computer programs that will permit efficient practical application of the basic material presented in this work. (Modified author abstract) GRA

N74-11030# Georgia Inst. of Tech., Atlanta.
AN INVESTIGATION OF THE ACCURACY OF FAR-FIELD RADIATION PATTERNS DETERMINED FROM NEAR-FIELD MEASUREMENTS
G. P. Rodrigue, E. B. Joy, and C. P. Burns Aug. 1973 267 p
(Contract DAAH01-72-C-0950)
(AD-766776) Avail: NTIS CSCL 09/5

The results reported show that far-field antenna patterns determined on the near-field range are as accurate as those determined on a far-field range. The patterns of a single plane, monopulse antenna, operated at 5.45 GHz were measured on a near-field range and two different far-field ranges, and detailed comparisons were made. The results of a computer-aided simulation study to determine the effects of various near-field measurement errors on the far-field patterns are also described. It was found that some near-field parameters are relatively critical; point source reflections are very deleterious. Far-field accuracy was found to be surprisingly insensitive to many near-field parameters. Comparisons of near-field and far-field techniques indicate several additional, non-technical, advantages of the near-field approach. Recommendations are made for future work to demonstrate the near-field technique on phased array antennas, and to improve the data processing procedures so as to increase the resolution of far-field patterns obtained from near-field measurements. Author (GRA)

N74-11031# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
EXPENDABLE HYDROPHONE FOR SONOBUOY APPLICATION Final Report
R. W. Timme, R. L. Davidson, and A. C. Tims 17 Sep. 1973 46 p refs
(NRL Proj. S02-36)
(AD-766786; NRL-7644) Avail: NTIS CSCL 17/1

A low-cost, low-noise, high-sensitivity hydrophone has been developed for possible application in an expendable, air-deployable, passive sonar array system. An acoustic element consisting of two Type 3 ceramic radially poled cylinders was combined with a low-noise, high-gain preamplifier to produce a hydrophone with a sensitivity of -149 db re 1 V/micro Pa, operating frequency range of 10 Hz to 3kHz, and depth capability of 4550 m. In addition to a description of the hydrophone and its operating specifications, a discussion of design criteria and prototype selection is included. Author (GRA)

N74-11032# University of Southern Calif., Los Angeles.
BIT SYNCHRONIZATION SYSTEM PERFORMANCE CHARACTERIZATION, MODELING, AND TRADEOFF STUDY
W. C. Lindsey 4 Sep. 1973 92 p refs
(Contract N61756-72-M-6443)
(AD-766794; NMC-TP-73-18) Avail: NTIS CSCL 09/4

The report presents the results obtained during the study on mathematical modeling of PCM bit synchronizers (also known as PCM signal conditioners). It is written in two parts. The first part presents results obtained on the study of the effects which bit synchronization has on the bit error rate (BER). The second part of the report is devoted to the study of bit synchronization performance characterization. A general discussion is given which highlights the many performance measures which serve to characterize the performance of BSS. Some general mathematical relations are given for evaluation of the acquisition time, acquisition range, and bit slippage rate for PCM bit synchronizers which are mechanized such that the phase detector characteristic is periodic. (Modified author abstract) GRA

N74-11033# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF THE RELATIONSHIP BETWEEN TECHNOLOGY AND COST OF AIRBORNE COMMUNICATIONS SYSTEMS M.S. Thesis
Michael J. McEuen Apr. 1973 91 p refs
(AD-766888; GSA/SM/73-13) Avail: NTIS CSCL 17/2

Statistical cost estimating techniques are used to analyze the relationship between technology and cost of airborne communications systems. The basic model examined is a two-stage model developed at the Rand Corporation for aircraft turbine engines. Multiple linear regression is used to initially develop a technological index for each system; and then this index is included in the cost equation to determine if the index improves the cost model to a significant degree. The technological index used is the date an airborne communications system can be expected to be operationally available. This date is calculated by regressing technical variables, which are meant to describe the technology of the system, on the actual date that the system is in use in the field. The actual date is the date of the basic Technical Order of each system, from which the technical data were gathered. (Modified author abstract) GRA

N74-11034# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFRACTION OF WAVES, CREATED BY A MAGNETIC-DIPOLE SYSTEM OF CURRENTS ON A SPHERE OF VARIABLE RADIUS
V. N. Krasilnikov and A. I. Liskov 6 Sep. 1973 23 p refs
Transl. into ENGLISH from the publ. "Problemy Difraksii i

Rasprostraneniya Voln" - USSR, 1972 p 192-201
(AD-766670; FTD-HT-23-798-73) Avail: NTIS CSCL 20/14

The diffraction of waves, created by a magnetic dipole system of currents on a sphere of variable radius, is studied. Author

N74-11035# Hawaii Univ., Honolulu.
LIBRARY STATUS: US PACIFIC AND SELECTED PACIFIC AREAS Background Report on Health Information Study
Julie Sirois Jul. 1973 182 p refs
(Contract PHS-71-4706; Proj. PEACESAT)
(PB-223044/9; LHNCBC-73-10) Avail: NTIS HC $5.25 CSCL 06E

The current status of library holdings, services, and activities in the U.S. Pacific and other areas of the Pacific (New Zeland, the Cook Islands, Fiji, Tonga, and Papua New Guinea) are discribed. Medical library resources are a major focus, but all types of libraries and library collections are included. The study involved a literature review and a questionnaire survey of Pacific Libraries. The information provided a basis for the design of a demonstration Pacific Library Network by satellite. GRA

N74-11036# National Academy of Engineering, Washington, D.C. Committee on Telecommunications.
TELECOMMUNICATIONS RESEARCH IN THE UNITED STATES AND SELECTED FOREIGN COUNTRIES: A PRELIMINARY SURVEY. VOLUME 1: SUMMARY
Jun. 1973 66 p Sponsored in part by NSF
(Contract H-1221)
(PB-222081/2) Avail: NTIS HC $4.50; HC also available $10.00/set of 2 reports as PB-222080-SET CSCL 17B

The report of the panel is presented in two volumes. This one (Volume I) is intended to provide the reader with an overview of the total study, as well as to present detailed results on some aspects. Topics discussed include: Status and trends of telecommunications research in the United States and selected foreign countries; summary conclusions of the telecommunications research panel; summary and recommendations of communications technology for urban improvement. GRA

N74-11037# National Academy of Engineering, Washington, D.C. Committee on Telecommunications.
TELECOMMUNICATIONS RESEARCH IN THE UNITED STATES AND SELECTED FOREIGN COUNTRIES: A PRELIMINARY SURVEY. VOLUME 2: INDIVIDUAL CONTRIBUTIONS
Jun. 1973 219 p refs
(Contract H-1221)
(PB-222082/0) Avail: NTIS HC $6.75 CSCL 17B

The Panel on Telecommunications Research of the Committee on Telecommunications made a preliminary survey of telecommunications research in this country and a comparison of it with similar research in other technologically advanced countries. The goal was to determine its adequacy, balance and relevance to U.S. national needs. The Panel effort has resulted in a two volume study. Volume 2 is a collection of original papers on a number of telecommunications-related topics which the Panel requested from its members and from outside experts in order to provide it with background material for its study. Topics discussed include: the systems approach; human factors; terminals, sensors and displays; transmission, modulation/demodulation and coding; switching, routing and control; and processing and storage. GRA

N74-11038# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
AN EXPERIMENT AND THEORETICAL INVESTIGATION OF DETECTION STATISTICS FOR OPTICAL FREQUENCY RADAR SYSTEMS AND COMMUNICATION SYSTEM Final Report, 1 Jul. 1970 - 30 Jun. 1973
Gerald Lachs 27 Jul. 1973 10 p refs
(Contract DAHC04-70-C-0046)
(AD-766962; AROD-8936-10-E) Avail: NTIS CSCL 17/8

The research accomplishments on detection statistics for opdar and light communications are briefly summarized. Details of the accomplishments are contained in the list of papers reported in the publications section of this report. GRA

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-11039# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 362
25 Oct. 1973 53 p Transl. into ENGLISH from various Eastern European publications
(JPRS-60361) Avail: NTIS HC $4.75

Two articles are presented which describe the software and hardware of the uniform system of digital computers utilized in the socialist countries of Eastern Europe. For individual titles, see N74-11040 through N74-11041.

N74-11040 Joint Publications Research Service, Arlington, Va.
HARDWARE OF UNIFORM SYSTEM OF DIGITAL COMPUTERS DESCRIBED
Jacenty Sobaniec *In-its* Transl. on Eastern Europe: Sci. Affairs, No. 362 (JPRS-60361) 25 Oct. 1973 p 1-32 Transl. into ENGLISH from Informatyka (Warsaw), Aug. 1973 p 2-16 (For availability see N74-11039 02-08)

A compilation of data is given, based on material presented at the Uniform System of Electronic Digital Computers Exhibit held in Moscow in May and June of 1973. The general characteristics of the uniform system of electronic digital computers as well as the classification of its hardware is presented. Individual computer models (central processing units, working storages, and channels) are extensively discussed. The following models are described: the EC-1010, produced by Hungary; the EC-1020A, produced by Czechoslovakia; the EC-1020, produced by Bulgaria and the USSR; the EC-1030, produced by Poland and the USSR; the EC-1040, produced by the GDR; and the EC-1050, produced by the USSR. Block diagrams of these models are included as well as a great deal of technical data released by the producers. Author

N74-11041 Joint Publications Research Service, Arlington, Va.
SOFTWARE OF UNIFORM SYSTEM OF DIGITAL COMPUTERS DESCRIBED
Wladyslaw Klepacz *In its* Transl. on Eastern Europe: Sci. Affairs, No. 362 (JPRS-60361) 25 Oct. 1973 p 33-38 Transl. into ENGLISH from Informatyka (Warsaw), Aug. 1973 p 16-19 (For availability see N74-11039 02-08)

Four operating systems for individual uniform system of electronic digital computers (JS EMC) models are presented. They are: OS-10 for the EC-1010, MOS (small operating system) for the EC-1020A, and DOS (disc operating system) and OS (operating system) for the remaining computer models. Packs of application programs and technical service programs are also described. Author

N74-11042*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Lompoc, Calif.
DIGITAL COMPUTER MONITORING STUDY
J. Perkinson 20 Apr. 1973 35 p
(NASA-TM-X-69443) Avail: NTIS CSCL 09B

Digital computer monitoring systems are presented with discussions on system description, and operational features. The systems described include the programmed logic for automatic teaching operations, direct digital control, electronic computer and reservoir simulation, control practice in the electric power industry, computer control of a power plant, and a control system for airplane maintenance. T.M.R.

N74-11043# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
PICTURE PROCESSING AND INTERACTIVE SYSTEMS. PART 2: INTERACTIVE SYSTEMS [SYMPOSIUM BILDVERARBEITUNG UND INTERAKTIVE SYSTEME. TEIL 2: INTERAKTIVE SYSTEME]
A. Kurau, comp. Porz, West Ger. 2 Jan. 1973 77 p refs
Partly in ENGLISH and partly in GERMAN; ENGLISH summary

Proc. of DFVLR Symp., Oberpfaffenhofen, West Ger., 10 Dec. 1971
(DLR-MITT-73-12) Avail: NTIS HC $6.00; DFVLR, West Ger. 24.60 DM

Some applications of interactive graphic computer systems are presented. An attempt is made to establish a classification of man machine interaction display systems, and some examples of such operational systems, in a large high-energy physics laboratory are described. The principles of using interactive graphic displays for representation of tabular data are described. Interactive time sharing terminal systems are considered for application to computer architecture. For individual titles, see N74-11044 through N74-11046.

N74-11044 European Organization for Nuclear Research, Geneva (Switzerland). Data Handling Div.
GRAPHICAL MAN-MACHINE INTERACTIVE SYSTEMS AT CERN
C. E. Vandoni *In* DFVLR Picture Process. and Interactive Systems, Pt. 2 2 Jan. 1973 p 9-27 refs (For availability see N74-11043 02-08)

An attempt is made to establish a classification of man-machine interaction display systems, and some examples of such systems, operational in a large high-energy physics laboratory, are described. Storage display and refreshed display are briefly described, as well as the software for graphic displays. The man-machine interaction systems are subdivided into special purpose systems and general purpose systems. An example of the first category is an interactive program for the design of particle beam transport; for the second, the graphically aided mathematical machine system, through which valuable experience has been gained. Present trends for a system for on-line applied mathematics are outlined. ESRO

N74-11045 Control Data G.m.b.H., Frankfurt am Main (West Germany).
PRINCIPLES OF INTERACTIVE GRAPHIC DATA PROCESSING [GRUNDLAGEN DER INTERAKTIVEN GRAPHISCHEN DATENVERARBEITUNG]
Ulrich M. Loeffler *In* DFVLR Picture Process. and Interactive Systems, Pt. 2 2 Jan. 1973 p 28-35 refs In GERMAN (For availability see N74-11043 02-08)

The principles of using interactive graphic displays for representation of tabular data are described. The display device consists of a cathode ray tube, covered with a raster of approximately 11 million computer addressable points. This XY-coordinate system allows the representation of a drawing, 20 by 20 cm, with an accuracy of up to 1/400 mm. A keyboard can be used for figure captions, or to communicate texts to the computer for new program selection and the documentation of results. The interactive device used is the light pen. ESRO

N74-11046 Control Data G.m.b.H., Frankfurt am Main (West Germany).
INTERACTIVE TIME SHARING TERMINAL SYSTEMS. NEW DEVELOPMENTS IN COMPUTER ARCHITECTURE [INTERAKTIVE TEILNEHMERSYSTEME. NEUE WEGE IN DER COMPUTER ARCHITEKTUR]
H. Clausen *In* DFVLR Picture Process. and Interactive Systems, Pt. 2 2 Jan. 1973 p 69-76 refs In GERMAN (For availability see N74-11043 02-08)

Interactive time sharing terminal systems are considered for application to computer architecture, exemplified by the AEC STAR system. The following requirements are fulfilled by this system: array processing; time sharing based, on real time multiplex methods; extensive support for FORTRAN, COBOL and PL/1; load distributed computing concept; consideration of the concepts of the Solomon 2 computer, the Atlas computer; and K. Iverson's book A Programming Language. ESRO

N74-11047# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
APPARATUS AND PROGRAMS FOR DIGITAL ANALYSIS OF FLUCTUATING QUANTITIES IN TURBULENT FLOW
A. Brandt and P. Bradshaw Apr. 1972 26 p refs
(Grants SRC-B/SR/7377; SRC-B/SR/8978)
(IC-AERO-72-11) Avail: NTIS HC $3.50

FORTRAN programs for the statistical analysis of digitized records of velocity-fluctuation measurements in turbulent flow are described. Details are given of data retrieval subroutines which deposit the unpacked magtape data into storage arrays, one for each analog data channel, and the analysis subroutines proper. The programs were developed primarily for conditional sampling of turbulence data but are adaptable to other types of random data analysis. ESRO

N74-11048# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
TEXT REPRESENTATION BY STROKEWRITING [TEXTDARSTELLUNG NACH DEM SCHREIBSTRAHLVERFAHREN]
K. R. Kimmel and K.-F. Kraiss Dec. 1972 85 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-5/72) Avail: NTIS HC $6.25; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. 6 DM

A technique for the generation of alpha-numeric characters is described. The synthesis of the characters was done by means of vectors and arcs, which provides a high quality of display. The presentation requires an XY-display (stroke writing technique). A flexible display design can be obtained with the availability of 4 raster sizes, 4 sign formats, and 4 alphabets each in an arbitrary range within the same picture. Moreover, larger gaps in the presentation can be bridged by jumps of the electronic beam, which results in good timing, as the picture frequency depends upon the volume of the input information. The operation of this display technique requires a minicomputer with the task of refreshing. The input of the alpha-numerics is done by means of the keyboard of a teletype. Author (ESRO)

N74-11508 Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems.
TEDIUM: IDEALIZED NEUTRON DATA FOR TESTING LIBRARY PROCESSING CODES
Mahlon Raymund *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1048-1060 refs (For availability see N74-11480 02-22)

N74-11514 Brookhaven National Lab., Upton, N.Y. National Neutron Cross Section Center.
THE BASIS OF CURRENT EVALUATED DATA FILES
M. K. Drake *In* AEC, Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1127-1151 refs Sponsored by AEC (For availability see N74-11480 02-22)

N74-11751 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE UTILIZATION OF THE ELECTRONIC DIGITAL COMPUTER FOR HISTORICAL-TECHNOLOGICAL ANALYSIS OF SPECIFIC FORMS OF TECHNOLOGY (THE EXAMPLE OF COAL MINING COMBINES)
L. P. Smirnov *In its* Anal.-of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 19-33 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 23-37 (For availability see N74-11749 02-34)

N74-11754 Joint Publications Research Service, Arlington, Va.
ON THE POSSIBILITY OF COMPARATIVE ANALYSIS WITH THE AID OF THE COMPUTER
E. F. Skorokhodko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 50-54 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 55-59 (For availability see N74-11749 02-34)

N74-11762 Joint Publications Research Service, Arlington, Va.
HISTORICAL EXPERIENCE IN THE DEVELOPMENT OF MECHANIZED DOCUMENTAL INFORMATION SYSTEMS
K. B. Gelman-Vinogradov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 126-130 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Progressa" Kiev, Naukova Dumka, 1967 p 127-131 (For availability see N74-11749 02-34)

N74-11763 Joint Publications Research Service, Arlington, Va.
INFORMATION RETRIEVAL SYSTEM FOR FINDING AND

PROCESSING INFORMATION IN PLANNING ORGANIZATIONS
L. G. Kazhdan *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 131-137 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnieheskogo Progressa" Kiev, Naukova Dumka, 1967 p 132-137 (For availability see N74-11749 02-34)

N74-11764 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE UTILIZATION OF EDGE PUNCH CARDS AND VISUAL CARDS IN REFERENCE INFORMATION WORK
M. M. Marchevskiy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 138-140 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 138-140 (For availability see N74-11749 02-34)

N74-11766 Joint Publications Research Service, Arlington, Va.
CODING OF COMPANY NAMES
B. N. Tardov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 149-155 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnieheskogo Progressa" Kiev, Naukova Dumka, 1967 p 149-154 (For availability see N74-11749 02-34)

N74-11767 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE SOLUTION OF SOME PROBLEMS OF GENERAL SCIENTOLOGY USING COMPUTER TECHNOLOGY
G. M. Dobrov and V. N. Klimenyuk *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 156-176 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukove Dumka, 1967 p 157-177 (For availability see N74-11749 02-34)

N74-11775 Joint Publications Research Service, Arlington, Va.
EXPERIENCE AND UTILIZATION OF COMPUTER TECHNOLOGY AT THE INSTITUTE OF HISTORY ACADEMY OF SCIENCES ESTONIAN SSR AND SOME PROSPECTS OF FUTURE DEVELOPMENT OF THESE WORKS
Kh. E. Palli *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 261-266 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova dumka, 1967 p 261-266 (For availability see N74-11749 02-34)

N74-11779 Joint Publications Research Service, Arlington, Va.
ON THE CRITERIA FOR THE CHOICE AND MEANS OF DEVELOPMENT OF MECHANIZED DATA RETRIEVAL SYSTEMS FOR STATE ARCHIVES
L. G. Khromchenko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 293-305 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 295-305 (For availability see N74-11749 02-34)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-11049* Duke Univ., Durham, N.C.
REGULATED dc-TO-dc CONVERTER FOR VOLTAGE STEP-UP OR STEP-DOWN WITH INPUT-OUTPUT ISOLATION Patent
Sam Yun-Ming Feng and Thomas G. Wilson, inventors (to NASA) Issued 6 Nov. 1973 9 p Filed 18 Apr. 1972 Supersedes N72-27230 (10 - 18, p 2401) Sponsored by NASA (NASA-Case-HQN-10792-1; US-Patent-3,771,040; US-Patent-Appl-SN-245063; US-Patent-Class-321-2; US-Patent-Class-321-18; US-Patent-Class-321-45S; US-Patent-Class-323-DIG.1; US-Patent-Class-331-62; US-Patent-Class-331-113A) Avail: US Patent Office CSCL 09E

A closed loop regulated dc-to-dc converter employing an unregulated two winding inductive energy storage converter is provided by using a magnetically coupled multivibrator acting as duty cycle generator to drive the converter. The multivibrator is comprised of two transistor switches and a saturable transformer. The output of the converter is compared with a reference in a comparator which transmits a binary zero until the output exceeds the reference. When the output exceeds the reference, the binary output of the comparator drives transistor switches to turn the multivibrator off. The multivibrator is unbalanced so that a predetermined transistor will always turn on first when the binary feedback signal becomes zero.
Official Gazette of the U.S. Patent Office

N74-11050* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUID PRESSURE AMPLIFIER AND SYSTEM Patent
Howell D. Garner and Richard F. Hellbaum, inventors (to NASA) Issued 6 Nov. 1973 9 p Filed 15 May 1972 Supersedes N72-27232 (10 - 18, p 2402)
(NASA-Case-LAR-10868-1; US-Patent-3,770,021; US-Patent-Appl-SN-253249; US-Patent-Class-137-819; US-Patent-Class-137-833; US-Patent-Class-137-840) Avail: US Patent Office CSCL 09E

A flueric beam-deflection amplifier and a method of controlling the same are described. Either a single or a series of cascaded fluid amplifier units are provided and each one of which may include the usual power nozzle, control nozzles, outlet passages and vent passages. All vent passages of each fluid amplifier unit lead to an enclosed vent outlet chamber which is connected to the ambient environment or to a return manifold through a variably restricted passage. To control the fluid amplifier unit, power and control stream pressures are first established, after which the restricted passage is reduced to regulate the input bias, the gain and the input impedance of the fluid amplifier unit.
Official Gazette of the U.S. Patent Office

N74-11051 Stanford Univ., Calif.
CADMIUM SELENIDE INFRARED PARAMETRIC OSCILLATOR Ph.D. Thesis
Richard Linsley Herbst 1973 96 p
Avail: Univ. Microfilms Order No. 73-14906

The linear and nonlinear properties of cadmium selenide were studied and a theoretical analysis and an experimental evaluation are presented of a singly resonant infrared parametric oscillator using CdSe for the nonlinear material. This device is a non-cryogenic source of tunable coherent radiation with a potential tuning range of 2.2 micron to 2 micron in the near infrared and 8 micron to 25 micron in the middle infrared. Using a Q-switched Nd:YAG laser operating at 1.833 micron as a pump source we have observed thresholds as low as 550 W and up to 40 % conversion efficiency. Operating in the signal only resonant configuration this oscillator has been angle tuned over the region 2.26 micron to 2.23 micron and 9.8 micron to 10.4 micron. In this experiment the wavelength range is limited by the geometric aperture of the crystal. The measured bandwidth of this device is 2/cm. The development and measurement of the physical properties of CdSe necessary for the construction of the parametric oscillator are also described. Dissert. Abstr.

N74-11052 Southern Methodist Univ., Dallas, Tex.
MINORITY-CARRIER SWEEPOUT IN THE INTRINSIC PHOTOCONDUCTOR Ph.D. Thesis
Stephen Perry Emmons 1972 227 p
Avail: Univ. Microfilms Order No. 73-14471

Minority carrier sweepout in the intrinsic photoconductor is manifested by a decreasing transient response time at high fields and a saturation of the photocurrent. These sweepout effects were repeatedly observed in Hg0.2Cd0.8Te for a variety of detectors and surface conditions. Steady-state gain saturation under chopped low-frequency illumination is reported, together with generation-recombination noise saturation, in narrow band gap Hg0.8Cd0.2Te exhibiting a 12 to 13 micron adsorption edge.

Direct observation of the transient response is reported for the first time. A dependence of Tau sub R on the reciprocal of the bias voltage is exhibited over an order of magnitude of bias. The use of the Q-switched laser to simulate an impulse response results in a linear dependence of the initial photocurrent on bias well into the sweepout region. Dissert. Abstr.

N74-11053 Compagnie des Ferrites Electroniques, Beaune (France).
HIGH FREQUENCY MnZn FERRITES AND NiZn FERRITES Final Report, 1 Jul. 1971 - 31 Dec. 1972 [FERRITES DE Mi-Zn-Zn POUR FREQUENCES ELEVEES ET FERRITES DE Ni-Zn RAPPORT FINAL]
R. Sibille 20 Feb. 1973 33 p In FRENCH
(Contract DGRST-71-7-2848)
HC $3.75

A study of Mn-Zn and Ni-Zn ferrites with linear temperature coefficient and high stability is presented. The frequency range of interest is 0.5 to 5 MHz. For the Mn-Zn ferrites the temperature coefficient is positive and linear in the range -40 to +70 C by substitution of Ti4+ ions to Fe3+ starting from classical compositions loaded in Fe2O3. The final composition retained is given and additives for resistivity and Foucault currents reduction are discussed. For the Ni-Zn ferrites, near-stoechiometric compositions are discussed together with a reduction in the Co content. ESRO

N74-11054 Societe Creusot-Loire, Paris (France).
DIELECTRIC MATERIALS FOR USE IN ELECTROSTATIC TYPE TRANSDUCERS Final Report [ETUDE DES MATERIAUX DIELECTRIQUES UTILISABLES DANS DES TRANSDUCTEURS ELECTROSTATIQUES]
J. Lewiner 20 Mar. 1973 20 p refs In FRENCH; ENGLISH summary
(Contract DGRST-70-72404)
Avail: Issuing Activity

The properties of the dielectric material in an electrostatic transducer for ultrasonic waves were analyzed. Three possible modes of operation are discussed: normal mode, electret mode, and superposition mode. The effects of the electric charges were studied: charge injection, charge trapping, trap depth, and lifetime. A method for obtaining better charge stability for the corona charged electrets is described. A zero current method was used for measurement. Evidence of piezoelectricity in thin polymeric films after charge injection was obtained. ESRO

N74-11055 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.
BEHAVIOR IDENTIFICATION AND SIMULATION OF MOS TRANSISTORS. PART 2: HIGH FREQUENCY PROPERTIES OF THE FIELD EFFECT TRANSISTOR WITH INSULATED GATE Final Report [IDENTIFICATION ET SIMULATION DU COMPORTEMENT DES TRANSISTORS MOS. DEUXIEME PARTIE: PROPRIETES EN HAUTES FREQUENCES DU TRANSISTOR A EFFET DE CHAMP A GRILLE ISOLEE RAPPORT FINAL]
H. Martinot and P. Rossel 15 Dec. 1972 183 p refs In FRENCH
(Contract DGRST-71-7-2835)
(Publ-981-Pt-2) Avail: Issuing Activity

A model of a MOSFET that takes into account substrate effects, mobility reduction, and the influence of parasitic elements, was determined for application to high frequencies. A system of general equations was established which determines the dynamic behavior of the transistor, and several solution methods are proposed. The factorial expressions for the impedance matrix of the action MOSFET zone were determined. The parasitic elements were taken into account. All the methods used for measuring the model's parameters are detailed. The performance criteria for high frequencies were examined to establish amplification limits of optimized MOS transistors. ESRO

N74-11056 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et de ses Applications Spatiales.
BEHAVIOR IDENTIFICATION AND SIMULATION OF MOS TRANSISTORS. PART 1: MOS TRANSISTOR BEHAVIOR IN THE SATURATED MODE Final Report [IDENTIFICATION ET SIMULATION DU COMPORTEMENT DES TRANSISTORS MOS. PREMIERE PARTIE: COMPORTEMENT DU TRANSISTOR MOS EN REGIME SATURE]
H. Martinot and P. Rossel 15 Dec. 1972 68 p refs In FRENCH
(Contract DGRST-71-7-2835)
(Publ-981-PT-1) Avail: Issuing Activity

A MOSFET model was developed for the saturation mode, based on an experimental analysis of the drain current and the saturation resistance in the pinch-off region. It was shown that a linear relation exists between the product (RdId) square and the drain voltage. Based on these results and a two-dimensional analysis, a model is proposed. The advantage of this model is an output conductance without peak variations in the transition zone between the pinched and nonpinched regions. ESRO

N74-11057 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
DEVELOPMENT TECHNOLOGIES FOR SIMPLE AND INTEGRATED TRANSDUCERS USING THE PIEZO-FIELD-EFFECT Final Report [ETUDE DES TECHNOLOGIES DE REALISATION DE TRANSDUCTEURS SIMPLES ET INTEGRES UTILISANT L'EFFET PIEZO DE CHAMP]
G. Nuzillat, A. Dunand, M. Gloanec, and J. Jarry Oct. 1972 238 p refs In FRENCH; ENGLISH summary
(Contract DGRST-71-7-2746)
Avail: Issuing Activity

A study of the manufacturing technology for mechanical transducers based on silica, using active elements with field effect, of the MOSFET or JFET type is reported. The behavior of these elements under mechanical stress and their applications in the field of analog pickups were investigated. The piezoresistivity of the silicon surface was quantitatively analyzed. Two families of transducer elements in MOSFET and JFET technology were realized, as well as an integrated piezo-FET circuit for impedance adjustment for an analog signal under 300 ohm. Performance and technology form a basis for production line, piezo-FET elements and the development of several functions. ESRO

N74-11058*# McDonnell-Douglas Corp., St. Louis, Mo.
PHASE-LOCKED SERVO SYSTEM Patent Application
Clifford Burdin, inventor (to NASA) Filed 26 Oct. 1973 19 p Sponsored by NASA
(NASA-Case-MFS-22073-1; US-Patent-Appl-SN-409991) Avail: NTIS HC $3.00 CSCL 09A

A phase-locked servo system is described for use in rotating a slip ring assembly at the exact velocity as one axis of a three-axis air bearing table. The system includes two servo loops. The first servo loop includes a rate gyroscope carried on an air bearing table which generates a signal through a summing junction circuit to be compared with a signal coming from a tachometer coupled to slip ring assembly. The corrective signal is applied to a torque motor for rotating the slip ring assembly. The second servo loop includes a pair of photo detector cells which generate pulses responsive to the rotation of the air bearing table and the slip ring assembly. These pulses are fed through a phase detector and a variable gain amplifier to a summing junction circuit for providing a fine adjustment signal to the torque motor for rotating the slip ring assembly. NASA

N74-11059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A ROLL-PITCH INTERACTION SIMULATOR AND A CONTROL POSITION COMMAND ENCODER FOR REMOTE PILOTING OF SPIN-ENTRY RESEARCH MODELS
Charles W. Meissner, Jr. Washington Nov. 1973 21 p
(NASA-TN-D-7361; L-9076) Avail: NTIS HC $2.75 CSCL 01C

The Langley Research Center uses radio-controlled, scaled aircraft models to study the spin-entry characteristics of aircraft. Recent spin-entry studies required the use of an electronic proportional-control system for manipulating model control surfaces. In order to meet control system requirements, a special-purpose analog computer was designed to simulate the coupling between roll and pitch controls. A digital encoder was designed to encode the voltage analogs of control-surface position into a special pulse format for transmission to the model. This

paper describes the two special developments and their relationship to the functions of the overall control system.
Author

N74-11060# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS FOR TESTING WIRE-BOND ELECTRICAL CONNECTIONS Final Report
Harry A. Schafft Nov. 1973 24 p refs Presented at 3d Symp. on Reliability in Electron., Budapest, 13-16 Nov. 1973
(NBS-TN-786) Avail: SOD HC $0.50 as C13.46:786

Several methods for reliability improvements are surveyed for failures that occur in integrated circuits due to failures of the wire bonds. Analyses with regard to the stress that the test imposes on the wire bond in the pull, centrifuge, mechanical shock, vibration, and temperature cycling tests are presented in the discussion on the capabilities and limitations of the methods.
Author

N74-11061# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
ANALYSIS OF THE DOPPLER FREQUENCY SPECTRUM OF ROTATING OBJECTS Ph.D.-Thesis - Tech. Univ. Munich [ANALYSE DES DOPPLERFREQUENZSPEKTRUMS ROTIERENDER KOERPER]
Georg Graf 17 Jul. 1972 167 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-46) Avail: NTIS HC $10.50; DFVLR, Porz, West Ger. 45.10 DM

The relationship between the Doppler frequency spectrum and the structure of a rotating body was investigated. It was shown that analysis of the intensities in the Doppler frequency spectra permits conclusions to be drawn on the shape of the body and that it is possible to get a highly resolved image of the object-seen from the direction of the axis of rotation-by appropriately processing the complex Doppler spectra. Both procedures are treated theoretically and are confirmed by experiments with microwaves of 3.2 cm wavelength.
Author (ESRO)

N74-11062# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
APPLICATION OF ELECTRON BEAM MASKING TECHNIQUES TO THE FABRICATION OF VHF ACOUSTIC COMPONENTS Final Report [APPLICATION DES TECHNIQUES DE MASQUAGE ELECTRONIQUE A LA REALISATION DE COMPOSANTS ACOUSTIQUES FONCTIONNANT A TRES HAUTE FREQUENCE RAPPORT FINAL]
P. Hartemann and C. Arnodo 12 Apr. 1972 45 p refs In FRENCH
(Contract DRME-70/34.515.00.480.75.01)
(Rept-4.513) Avail: NTIS HC $4.25

The electron masking technique was applied to the development of surface acoustic wave transducers working at VHF. Some technological problems were solved, namely the evacuation of electric charges at the piezoelectric substrate surface by means of a metallic layer deposition on the sample. The influence of electron scattering and retroscattering on the resin at vincinity of the joint between comb teeth and the common electrode was investigated. To verify the validity of the technological procedure various delay lines were developed and tested, and insertion loss values were compared. Future developments of large passband (600 MHz) delay lines on lithium niobate, with 10 microsec delay functioning at a 1.5 GHz control frequency are envisaged.
ESRO

N74-11063# Royal Aircraft Establishment, Farnborough (England).
A MULTIPLEXER AND SIGNAL CONDITIONER FOR USE WITH VIBRATION TRANSDUCERS
P. G. Herrington and P. Hamer Jul. 1973 23 p
(RAE-TR-73055; BR36036) Avail: NTIS HC $3.25

An electronic unit designed to sequentially sample and amplify the outputs of four piezoelectric vibration transducers was described. Design features include simple adjustment of the sampling rate and scale factor. In addition, by separate external commands the unit can be reset to sample the first transducer and change the system amplification. This unit was developed as part of the instrumentation required to telemeter the results of vibration measurements made on the structure of the Black Arrow satellite launching vehicle, but was not flown before cancellation of the project. The extensive use of integrated circuits in this unit leads to a design readily adaptable for other uses requiring sequential sampling.
Author (ESRO)

N74-11064# Radio Corp. of America, Princeton, N.J.
DG-ELECTROLUMINESCENT FLAT PANEL DISPLAY Final Report
Joseph J. Hanak and P. Neil Yocom Aug. 1973 115 p refs
(Contract DAAB07-69-C-0290; DA Proj. 1S6-62705-A-055)
(AD-766741; PRRL-73-CR-10; ECOM-0290-F-69) Avail: NTIS CSCL 09/5

The objective of this project was to develop an efficient electroluminescent configuration using II-VI materials, appropriate for construction of an inexpensive, flat panel display. The materials system was to be developed as far as possible within the resources of the project, and a sample panel was to be constructed. The approach found most suitable for the goal was the ZnSMnCu dc electroluminescent (EL) phosphor, and it was pursued by a major and minor investigation. The minor investigation was that of a powder phosphor of ZnSMn coated with a copper sulfide layer. These powders were then used in conjunction with a plastic binder to make EL layers. The major effort of this project was on sputtered films of ZnSMnCu. Automated methods of material evaluation were used to determine optimum film composition, and means of obtaining constant composition over wide areas. It was found that current-limiting layers in the form of cermets were necessary to prevent breakdown of the EL films. With these protected EL films the performance from the standpoint of brightness, efficiency, and life has been increased by at least an order of magnitude over the existing state of the art for dc electroluminescent thin films. A test display consisting of a matrix of 7 x 39 X-Y addressable cells was fabricated by inexpensive photolithographic techniques. (Modified author abstract)
GRA

N74-11065# Antenna Corp. of America, Harleysville, Pa.
IMPROVEMENT OF PERFORMANCE CHARACTERISTICS OF A CLASS OF BROADBAND CIRCULARLY POLARIZED ANTENNAS Final Report
Sep. 1972 129 p refs
(Contract N62269-72-C-0325)
(AD-766473) Avail: NTIS CSCL 09/5

The report covers a development program for the improvement of performance characteristics of a class of broadband circularly polarized antennas for use with tactical airborne jamming equipment. A historical record of the program, testing procedures, significant results, conclusions, and recommendations are covered.
Author (GRA)

N74-11066# Army Electronics Command, Fort Monmouth, N.J.
SYNCHRONOUSLY TUNED FERRITE POWER LIMITED FOR BROADBAND SYSTEMS APPLICATION
Samuel Dixon, Jr. Jul. 1973 27 p refs
(DA Proj. 1S6-62705-A-057)
(AD-766674; ECOM-4137) Avail: NTIS CSCL 09/5

The investigation describes analytical and experimental results obtained on a broadband frequency selective ferrite limiter at K sub u-band which uses a synchronously tuned waveguide bandpass structure. This device is aimed at providing protection for communications and electronic warfare receiver systems over a bandwidth from 12 to 30 per cent at K sub u-band frequencies. The circuit consist of a series of three cavities in waveguide transmission line, the coupling being accomplished via the irises or symmetrical inductive slits between cavities. Because of this cavity structure, the observed threshold power levels have been reduced by an order of magnitude. Using a combination of single crystal YIG and lithium ferrite rods, the threshold power for limiting varies from 0.75 watts at 16.0 GHz to 2.0 watts at 17.0 GHz with an insertion loss of 0.9 dB.
Author (GRA)

N74-11067# Avco-Everett Research Lab., Everett, Mass.
DEVELOPMENT OF A PULSED HIGH-ENERGY INDUCTIVE ENERGY STORAGE SYSTEM Final Technical Report

J. Teno, O. K. Sonju, and J. M. Lontai Aug. 1973 308 p refs
(Contract F33615-71-C-1455; AF Proj. 3145)
(AD-766518; AFAPL-TR-73-49) Avail: NTIS CSCL 09/1

The work was concerned with the complete investigation and feasibility demonstration of superconducting inductive energy storage systems capable of producing high power pulses in the 200 microsecs range on a reptitive basis. The system studied was a 100 kJ system. A 15 kJ model system was successfully tested. Also, as part of the program, a complete investigation of switches appropriate for short pulse inductive energy storage systems was made. The investigation led to the preliminary development of a multiple contact high speed switch which was successfully tested in model size. (Modified author abstract) GRA

N74-11068# Harry Diamond Labs., Washington, D.C.
LOW-PROFILE VHF ANTENNAS FOR SEISMIC DETECTION SYSTEMS
Frank Reggia Jun. 1973 51 p refs
(HDL Proj. 117215)
(AD-766703; HDL-TR-1635) Avail: NTIS CSCL 09/5

The paper describes the design, fabrication, and evaluation of three different types of low-profile VHF antennas and their applications with seismic detection systems at or near ground level. These electrically small antennas (vertically polarized) include a capacitively tuned multi-turn loop over a small metal ground plane, a spiral transmission line top-loaded monopole, and a capacitor-plate antenna that can be inductively tuned over a wide frequency range. The radiation pattern of each is essentially that of a dipole, omnidirectional in the horizontal plane and represented by a solid of revolution generated by a rotating figure of 8. All of the above elemental dipole antennas were designed for optimum performance in the 100- to 200 MHz frequency range, compatible with various physical, electrical, and environmental constraints determined by the terminal delivery vehicle (TDV) of the seismic detector system. Distinctive features of these low-profile antennas include small size (3 in. maximum), simplicity of construction, and low fabrication costs.
Author (GRA)

N74-11069# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
FEASIBILITY OF USING FINITE ELEMENTS IN ANALYSIS OF SECOND BREAKDOWN IN SEMICONDUCTOR DEVICES
H. B. Wilson, J. H. Hill, and D. Mathews 8 Jun. 1973 26 p refs
(AD-766688; RG-73-14) Avail: NTIS CSCL 09/1

Mathematical characterization of the operation of a transistor during second breakdown has proved to be extremely complicated, because not only is it impossible to make the usual one-dimensional approximations of ordinary transistor analysis, but there is also a strong spatial dependence on temperature (the material may even change state) and the extremes of operating conditions prevail. Moreover, a highly time-dependent solution is required. As a means of demonstrating the utility of the method of finite elements in analyzing semiconductor performance, a numerical method is developed for predicting two-dimensional flow in a pn junction before, during, and after second breakdown and including damage. The model accounts for spatial and temporal dependence of voltage, temperature, hole density, and electron density. The ease with which oddly shaped boundaries, material inhomogeneities, and nonlinear variation of coefficients is handled by the method of finite elements is discussed.
Author (GRA)

N74-11070# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Electronics Support Div.
EVALUATION OF INFRARED THERMAL PROFILE ANALYSIS FOR ELECTRONIC CIRCUIT CARD TESTING Final Report, Oct. 1971 - Jul. 1973
Thomas M. Murphy 17 Jul. 1973 23 p
(Contract AF Proj. 1559)
(AD-766594; ASD-ENCE-N-72-8-1) Avail: NTIS CSCL 09/5

The report includes an evaluation of infrared radiation used to detect and isolate failures in electronic circuit cards.
Author (GRA)

N74-11071# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Quarterly Progress Report, 1 Dec. 1972 - 1 Mar. 1973
G. I. Haddad, R. J. Lomax, and D. Tang Jun. 1973 129 p refs
(Contract F30602-71-C-0089; AF Proj. 5573)
(AD-766769; RADC-TR-73-157; QPR-10) Avail: NTIS CSCL 09/1

The tenth quarterly report investigates theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification, and control. Current tasks under this program are: Modulation properties of Gunn-effect devices, nonlinear operating characteristics of IMPATT diodes, high-efficiency avalanche diodes, properties of TRAPATT diodes, field-effect transistors, CW power capability of IMPATT devices, solid-state device fabrication. GRA

N74-11072# Aerospace Corp., El Segundo, Calif.
HELICAL RESONATOR FOR VHF SQUID OPERATION
Linton R. Corruccini 28 Sep. 1973 14 p refs
(Contract F04701-73-C-0074)
(AD-766714; SAMSO-TR-73-270) Avail: NTIS CSCL 14/2

A convenient resonator for SQUID magnetometer operation in the 30 MHz - 1 GHz frequency range is described. The device offers a practical means of using an expected linear increase in SQUID sensitivity with bias frequency throughout this range. Experimental results, which demonstrate this effect at 460 MHz, are presented. Author (GRA)

N74-11073# IIT Research Inst., Chicago, Ill.
MICROCIRCUIT DEVICE FAILURE RATES
Irvin L. Krulec Jun. 1973 202 p refs
(Contract F30602-73-C-0065)
(AD-766917; RAC-MDFR-0673) Avail: NTIS CSCL 09/5

A compendium is presented of microcircuit device failure rates organized by device type and manufacturer. This listing of 2285 entries is compiled from data generated during government, industrial test programs and system operations. Each entry contains a description of the device configuration, applied stress conditions and the failure rate statistics, including modes of observed failures. Failure rates are computed at the upper 60% confidence level assuming an exponential failure distribution. The compendium is completely updated and reissued annually.
GRA

N74-11074# Machlett Labs., Inc., Stamford, Conn.
ELECTRON BEAM SEMICONDUCTOR DEVICES Final Report, 1 Mar. 1972 - 21 Feb. 1973
M. Braun and K. Garewal Jul. 1973 22 p refs
(Contract DAAB07-72-C-0131)
(AD-766740; ECOM-0131-F-72) Avail: NTIS CSCL 09/5

During the course of the contract, five EBS amplifiers, designated as EE-154 A and B, were developed, fabricated and delivered to the USAECOM. Diode area was 10 sq. cm and 20 sq. mm, active width of N region 25 micrometers, with resistivity of 20 ohm-cm. The electron beam of the amplifiers is generated and modulated by a cathode grid structure, with a focus electrode for beam diameter control. Best back bias voltage of the 20 diodes delivered exceeds 400 volts, with an average of 300 volts. First tests at USAECOM were done on a 20 sq. mm diode tube at 235V back bias voltage. Peak current into 3.8 ohm load was 46A, a peak power of 8 KW with a pulse risetime of 1.5 ns. Risetime, when corrected for the input pulse, is approximately 1 ns. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-11075 Radiotechnique-Compelec, Paris (France). Lab. Couches Minces.

PASSIVE COMPONENTS ADAPTED FOR HF UTILIZATION Final Report [COMPOSANTS PASSIFS CARACTERISES POUR LEUR EMPLOI AUX HYPERFREQUENCES]
Jean Pompei Oct. 1972 18 p In FRENCH
(Contract DGRST-70-72-567)
(TL-15-JP/YE-CRM-153) Avail: Issuing Activity

Passive components adapted for HF utilization are studied for their compatibility with gold coated electric networks. Technological studies are reported for mounting and encapsulating such passive discrete components on ceramics with high Al2O3 content, silicon and corindon, silica doped glass or SiO2. The passive components discussed are: the localized constants type-R.L.C. either stemming from the network itself or discrete and connected by direct, thermocompression inverted, welding; distributed constants type-filters, attenuators, coupling circuits, for use at UHF and C band. The feasibility of sealing a ceramic ring or metallic radiator onto metallized ceramic substrates is demonstrated. HF characterization and qualification of Ni-Cr resistors on Al2O3 and MOS capacitors (Si-thermal SiO2 Metallic contacts) are presented. ESRO

N74-11076*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DECOUPLING IN LINEAR TIME-VARYING MULTIVARIABLE SYSTEMS
Viswanathan Sankaran Washington Nov. 1973 38 p refs (NASA-TN-D-7458; L-9181) Avail: NTIS HC $3.00 CSCL 09C

The necessary and sufficient conditions for the decoupling of an m-input, m-output, linear time varying dynamical system by state variable feedback is described. The class of feedback matrices which decouple the system are illustrated. Systems which do not satisfy these results are described and systems with disturbances are considered. Some examples are illustrated to clarify the results. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-11077*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. 1972 - 30 Jun. 1973
D. K. Frederick, P. K. Lashmet, G. N. Sandor, C. N. Shen, E. V. Smith, and S. W. Yerazunis 30 Jun. 1973 175 p refs
(Grant NGL-33-018-091)
(NASA-GR-136069; RPI-TR-MP-35) Avail: NTIS HC $10.75 CSCL 13F

Problems related to the design and control of a mobile planetary vehicle to implement a systematic plan for the exploration of Mars are reported. Problem areas include: vehicle configuration, control, dynamics, systems and propulsion; systems analysis, terrain modeling and path selection; and chemical analysis of specimens. These tasks are summarized: vehicle model design, mathematical model of vehicle dynamics, experimental vehicle dynamics, obstacle negotiation, electrochemical controls, remote control, collapsibility and deployment, construction of a wheel tester, wheel analysis, payload design, system design optimization, effect of design assumptions, accessory optimal design, on-board computer subsystem, laser range measurement, discrete obstacle detection, obstacle detection systems, terrain modeling, path selection system simulation and evaluation, gas chromatograph/mass spectrometer system concepts, and chromatograph model evaluation and improvement. Author

N74-11078# Joint Publications Research Service, Arlington, Va.
LUNOKHOD-1: MOBILE LUNAR LABORATORY
22 Nov. 1971 189 p refs Transl. into ENGLISH of the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 128 p
(JPRS-54525) Avail: NTIS HC $11.50

The development and characteristics of the Lunokhod 1 automatic vehicle for lunar exploration are discussed. The subjects presented are: (1) general design and construction, (2) remote control systems, (3) heat regulating systems, (4) scientific instrumentation, (5) ground mechanical properties, and (6) cosmic ray research. For individual titles, see N74-11079 through N74-11089.

N74-11079 Joint Publications Research Service, Arlington, Va.
GENERAL DESIGN AND CONSTRUCTION OF LUNA-17 STATION
K. S. Anisov, V. I. Mastakov, O. G. Ivanov, L. N. Leonidov, G. N. Nikolayev, A. D. Dneprov, A. K. Aleksandrov, P. S. Semenov, A. F. Grachev, V. I. Komarov et al *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 4-27 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

The design and operation of the Luna 17 and the Lunokhod-1 systems for lunar exploration are described. The Luna-17 automatic station consists of two main parts, a unified landing stage and an automatic self-propelled vehicle, the Lunokhod-1. The unified landing stage is an independent rocket unit designed for making flight trajectory corrections on the earth-moon path, putting the station into lunar orbit, and implementing a prelanding circumlunar orbit followed by a soft landing on the lunar surface. The Lunokhod-1 is a self-propelled vehicle automatically controlled from the earth and is designed to traverse the lunar surface. Author

N74-11080 Joint Publications Research Service, Arlington, Va.
RADIO COMPLEX, CONTROL SYSTEM AND SOURCE OF ELECTRIC CURRENT
V. P. Puchkov, L. L. Puchenko, F. I. Babkov, R. O. Belova, O. G. Ivanov, V. I. Malin, A. S. Makov, I. B. Merkov, Ye. G. Uzkiy, N. A. Heleznov et al *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 28-40 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

The functions of the control system of the Luna-17 automatic station are described. The control system consists of gyroscopic instruments, computers, engine control units, commutating units, and actuating components. The angular deviations of the station from stipulated spatial, normal, lateral, and angular velocity components are determined by using a system of gyroscopic instruments in the automatic stabilization system. The specific systems which are analyzed are: (1) station astroorientation system, (2) radio control systems of Luna-17 and Lunokhod-1, (3) antenna feeder systems, and (4) electric current systems. Author

N74-11081 Joint Publications Research Service, Arlington, Va.
THERMAL REGIME AND HEAT REGULATING SYSTEM
A. I. Yelenov, A. M. Rybin, and A. S. Yakovlev *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 41-46 Transl. into ENGLISH from the book, "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Design principles of heat regulating and cooling systems necessary for normal and reliable functioning of the Luna 17 automatic station during earth-moon flight is discussed. E.H.W.

N74-11082 Joint Publications Research Service, Arlington, Va.
CONTROL AND RESULTS OF PROGRAM IMPLEMENTATION
A. A. Aleksandrov, P. A. Artemyev, G. I. Bogatov, I. A. Yelenov, O. G. Ivanov, V. A. Ryvkina, Ye. G. Uzkiy, A. I. Shakhov, F. P. Pavlov, Yu. P. Kotlov et al *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 47-74 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-

1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

The operation of Lunokhod's closed automatic control system is described. Lunokhod, designed for safe movement along the lunar surface in a stipulated direction with maximum mean velocity, is ground controlled through radio equipment and monoscopic television images by operators. Monoscopic television images of lunar terrain in front of Lunokhod are transmitted to the operator who determines the possibilities of movement over it and gives appropriate commands. Trajectories are also calculated from the images and used to lay out the route to be followed by the vehicle. E.H.W.

N74-11083 Joint Publications Research Service, Arlington, Va.
DESIGN CHARACTERISTICS AND PRINCIPAL PARAMETERS OF LUNOKHOD-1 TELEVISION SYSTEMS
A. S. Selivanov, V. M. Govorov, V. V. Zasetskiy, and V. A. Timokhin *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 75-96 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Comparative analysis and experimental tests were made of television systems designed for Lunokhod 1. The systems were designed to: (1) control Lunokhod movement, (2) study geological, morphological, and topographic characteristics of the lunar surface, and (3) observe the earth and sun for navigation purposes. Test results show that the best television system for investigating lunar surface structure and carrying out topographic surveys, as well as observing celestial bodies is one having transmitting cameras with opticomechanical scanning. An electronic slow frame system was deemed best for monitoring movement. E.H.W.

N74-11084 Joint Publications Research Service, Arlington, Va.
STUDY OF LOCAL TERRAIN ALONG THE LUNOKHOD-1 TRAJECTORY c30
B. N. Rodionov, B. V. Nepoklonov, and V. V. Kiselev *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 97-112 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Along its movement trajectory, lunokhod-1 made a topographic survey of a terrain strip up to 150 m wide. The survey method involved running a control traverse and taking television panoramas and photographs at stopping points. Terrain images were obtained using four panoramic and two course television cameras. The images were photographically registered at the reception point, and relief elements and the topographic situation were interpreted from them. Some of the problems involved in the method for constructing topographic diagrams are discussed along with the significant results. D.L.G.

N74-11085 Joint Publications Research Service, Arlington, Va.
DETERMINING GEOMETRIC DIMENSIONS AND DISTRIBUTION OF CRATERS TRAVERSED BY LUNOKHOD-1 ON LUNAR SURFACE c30
B. I. Garin, A. K. Leonovich, F. P. Pavlov, V. B. Georgiyev, and P. S. Semenov *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 113-119 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Investigations have demonstrated that the dimensions of craters, as well as their position relative to the Lunokhod-1 movement trajectory, can be computed from the results of changes in the traversed path with sufficient accuracy. For this purpose, a method was developed for determining the dimensions of craters on the lunar surface traversed by Lunokhod-1 on the basis of telemetric information from the sensors registering the Lunokhod-1 path. The method has two modifications, geometric and analytic, the latter making it possible to solve the problem of determining the parameters of lunar craters with a digital computer, and to ascertain the characteristics of lunar relief in tempo with the spacecraft movement. D.L.G.

N74-11086 Joint Publications Research Service, Arlington, Va.
STUDIES OF LUNAR GROUND MECHANICAL PROPERTIES WITH THE SELF-PROPELLED LUNOKHOD-1 c30
A. K. Leonovich, V. V. Gromov, A. V. Rybakov, V. K. Petrov, P. S. Pavlov, I. I. Cherkasov, and V. V. Shvarev *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 120-135 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Experiments carried out on Lunokhod-1 made it possible to obtain information on the possible diversity of the mechanical properties of lunar ground under natural conditions over an extensive area. The investigations with Lunokhod-1 were made by several methods including: (1) A special instrument was used in introducing and rotating a conical-bladed punch in the ground. With the penetration of the punch, it was possible to determine the indices of ground carrying capacity and its compactibility. (2) Continuous measurements were made of the parameters of interaction between the undercarriage of the self-propelled vehicle and the ground. An approximate estimate was obtained of the mechanical properties of the lunar ground along the entire trajectory. (3) The nature of ground destruction under the influence of the Lunokhod wheels was analyzed from photopanoramas. Ground structure and texture were evaluated from the depth of the tracks and the nature of ground deformation during movement of the vehicle. D.L.G.

N74-11087 Joint Publications Research Service, Arlington, Va.
THE RIFMA LUNAR AUTOMATIC SPECTROMETRIC APPARATUS c14
G. Ye. Kocharov, N. F. Borodulin, S. V. Viktorov, O. M. Voropayev, A. Yu. Dzevanovskaya, O. G. Ivanov, G. V. Kiryan, V. V. Petrov, and V. A. Sakulskiy *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 136-146 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

An X-ray spectrometer was carried on the Lunokhod lunar roving vehicle for speedy ground analysis on the chemical composition of the lunar surface. The apparatus contained radioactive sources for irradiating the lunar ground, detectors for registering ground X-radiation, and electronic devices for signal registration and processing. The spectrometric apparatus provided speedy analyses of the chemical composition of the lunar ground along the Lunokhod trajectory in the Mare Imbrium. A summary of the chemical compositions for different regions of the lunar surface is presented in the tabular form. G.G.

N74-11088 Joint Publications Research Service, Arlington, Va.
PRELIMINARY RESULTS OF GEOMORPHOLOGICAL STUDY OF PANORAMAS c30
K. P. Florenskiy, A. T. Bazilevskiy, A. A. Pronin, and Z. V. Popova *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 147-174 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Preliminary geological-morphological interpretations of Lunokhod lunar panoramas establish craters as the dominant relief feature in the western sector of the Mare Imbrium. The craters are separated into different morphological classes, rocks, and some other microrelief features. Photographs also show a system of elongated gently sloping ridge-like highlands and sea ridges, with widths up to several kilometers, lengths of tens and hundreds of kilometers, and elevations of 300 to 500 m. G.G.

N74-11089 Joint Publications Research Service, Arlington, Va.
COSMIC RAY RESEARCH c29
S. N. Vernov, G. P. Lyubimov, Ye. A. Chuchkov, and N. N. Kentor *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 175-189 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

Radiometric instrumentation carried onboard lunokhod measured the intensity of solar and galactic cosmic rays, the composition of solar cosmic rays, energy spectra, and angular distributions of solar protons. Registrations of increased proton intensities during the period 9 to 22 December, 1970, concurred with a series of solar flares in the eastern and central parts of the solar disk. G.G.

N74-11090*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA SUPERCONDUCTING MAGNETIC MIRROR FACILITY
J. J. Reinmann, M. C. Swanson, C. R. Nichols, S. J. Bloy, L. A. Nagy, and F. J. Brady 1973 6 p refs Presented at the 5th Symp. on Engr. Probl. of Fusion Res., Princeton, N. J., 5-9 Nov. 1973
(NASA-TM-X-71480) Avail: NTIS HC $3.00 CSCL 20I

The design details and initial test results of a superconducting magnetic mirror facility that has been constructed at NASA Lewis Research Center for use in thermonuclear research are summarized. The magnet system consists of four solenoidal coils which are individually rated at 5.0 T. Each coil is composed of an inner, middle, and outer winding. The inner winding is wound of stabilized Nb3Sn superconducting ribbon, and the middle and outer windings are wound of stabilized Nb-Ti superconducting wire. When arranged in the mirror geometry, the four coils will produce 8.7 T at the mirrors and a 1.8 mirror ratio. The magnet has a 41-cm diameter clear bore which is open to atmosphere. Distance between the mirrors is 111 cm. Presently there are only three magnets in the facility; the fourth magnet is being rebuilt. Author

N74-11091*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TEST OF LOX COMPATIBILITY FOR ASPHALT AND CONCRETE RUNWAY MATERIALS
C. V. Meyers, Coleman J. Bryan, and Billy J. Lockhart Dec. 1973 34 p refs
(NASA-TM-X-64086; KSC-MTB-238-72) Avail: NTIS HC $3.75 CSCL 01E

A literature survey and a telephone canvass of producers and users of LOX is reported which yielded one report of an accident resulting from a LOX spill on asphalt, one discussion of hazardous conditions, and an unreferenced mention of an incident. Laboratory tests using standard LOX impact apparatus yielded reactions with both old and new alphalt, but none with concrete. In the final test, using a larger sample of asphalt, the reaction caused extensive damage to equipment. Initial field experiments using 2-meter square asphalt slabs covered with LOX, conducted during rainy weather, achieved no reaction with plummets, and limited reaction with a blasting cap as a reaction initiator. In a final plummet-initiated test on a dry slab, a violent reaction, which appeared to have propagated over the entire slab surface, destroyed the plummet fixture and threw fragments as far as 48 meters. Author

N74-11092*# Linguistic Systems, Inc., Cambridge, Mass.
GROUND LIGHTING EQUIPMENT
M. Gouet Washington NASA Nov. 1973 10 p Transl. into ENGLISH of the publ. "Les Materiels de Balisage" Paris, Assoc. Franc. des Ingr. et Techniciens de l'Aeron. et de l'Espace, 1967 9 p Presented at 8th Intern Aeron. Congr., Paris, 29-31 May 1967
(Contract NASw-2482)
(NASA-TT-F-15176) Avail: NTIS HC $3.00 CSCL 01E

The importance of visual aids in airport ground lighting equipment is discussed in terms of lower operational standards. Different types of light beaconing devices are presented along with the effects of the lowering of minimums on aircraft guidance and landing. The lighting equipment used in France is also described. T.M.R.

N74-11093*# Linguistic Systems, Inc., Cambridge, Mass.
VISUAL LANDINGS IN REGIONAL AND LOCAL AIRPORTS
Silvia Schellenberg Washington NASA Nov. 1973 15 p refs Transl. into ENGLISH from AEG Mitt. (W. Germany), v. 62, 1972 p 34-39
(Contract NASw-2482)
(NASA-TT-F-15177) Avail: NTIS HC $3.00 CSCL 01E

The basic plans for the ground lighting facilities worked up by AEG-Telefunken in cooperation with the German Federal Institute for Flying safety are presented. The program is broken down into five sections, each section offering recommendations for the different situations found at most regional airports. These sections are: (1) lighting the takeoff and loading runways, (2) obstacle lights and beacons, (3) runway beaconing, (4) approach beaconing, and (5) switching and control systems. Author

N74-11094*# Kanner (Leo) Associates, Redwood City, Calif.
INFORMATION CONTENT OF DIFFERENT RUNWAY LIGHTING PATTERNS
J. Kylstra and J. Hoogerheide Washington NASA Nov. 1973 13 p refs Transl. into ENGLISH from Aeromed. Acta (Soesterburg), v. 9, 1963 1964 p 21-29
(Contract NASw-2481)
(NASA-TT-F-15179) Avail: NTIS HC $3.00 CSCL 01E

Commercial pilots sitting before and looking at a television screen, on which were presented moving dots or bars simulating an approach to a visual landing system, were asked to discriminate between level flight or flight with change in altitude in the sense of a descent. There were 4 patterns of light markings: single row, double row, single crossbars and double crossbars. Changes in altitude were significantly better observed in the double patterns than in the single patterns. Author

N74-11095*# Kanner (Leo) Associates, Redwood City, Calif.
SELECTED PROBLEMS REGARDING THE FORMATION OF A SIMULATION MODEL
K. H. Unterreiner Washington NASA Nov. 1973 15 p Transl. into ENGLISH from "Report on the Third Meeting of the DGLR-Symposium, Flight Testing Technology: Reliability of Results derived from Simulation in Comparison with Results of Actual Flight", West German report DLR-Mitt-72-18, Oct. 1972 p 67-78 Conf. held at Bremen, 28 Apr. 1972
(Contract NASw-2481)
(NASA-TT-F-15173) Avail: NTIS HC $3.00 CSCL 14B

Selected problems in the formation of simulation models are presented. The construction of a flight control system for a V/STOL aircraft simulator is used as the example. Sources of errors in the construction of the system are explained and diagrams of typical systems are provided. Graphs of response curves and a table of performance data are included. Author

N74-11096*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOTION SOFTWARE FOR A SYNERGISTIC SIX-DEGREE-OF-FREEDOM MOTION BASE
Russell V. Parrish, James E. Dieudonne, and Dennis J. Martin, Jr. (Electron. Assoc., Inc.) Washington Dec. 1973 44 p refs (NASA-TN-D-7350; L-8798) Avail: NTIS HC $3.00 CSCL 14B

Computer software for the conversion of fixed-base simulations into moving-base simulations utilizing a synergistic six-degree-of-freedom motion simulator has been developed. This software includes an actuator extension transformation, inverse actuator extension transformation, a centroid transformation, and a washout circuit. Particular emphasis is placed upon the washout circuitry as adapted to fit the synergistic motion simulator. The description of the washout circuitry and illustration by means of a sample flight emphasize that translational cue representation may be of good fidelity, but care in the selection of parameters is very necessary, particularly in regard to anomalous rotational cues. Author

N74-11097*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMIZATION OF WAVE CANCELLATION IN VARIABLE POROSITY TRANSONIC WIND TUNNEL FLOWS
John William Davis Washington Nov. 1973 137 p refs (NASA-TN-D-7432; M-108) Avail: NTIS HC $4.50 CSCL 14B

A technique has been developed which is capable of determining the optimum wall configuration for a variable porosity perforated wall transonic wind tunnel. The technique is based on a mathematical model arrived at by considering the results of theory and past experimental investigations. A performance index was determined as a function of the significant wind tunnel parameters by comparing a formulation of this mathematical model, using MSFC 14 inch Trisonic Wind Tunnel experimental results, to interference free results. The resulting relationship was then used to determine the combination of wind tunnel parameters which should yield minimum reflected wave interference. A theoretical development of wall porosity requirements for thick

wall inclined hole test sections is included which follows the trends and generally the magnitude of available experimental data. This theory is useful in studying the present variable porosity case, but also should be of value in studies concerning the wave cancellation process for fixed porosity walls. Author

N74-11098# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
CALIBRATION OF SECOND ATLAS S183 FLIGHT MODEL, PART 1 [CALIBRATIONS DU MODELE DE VOL NO. 2 ATLAS S183 (1ERE PARTIE)]
M. Saisse and A. M. Sautivet 24 Feb. 1972 37 p In FRENCH
(OPT-008-72) Avail: NTIS HC $4.00

Vacuum chamber and clean room calibration measurements for the Skylab program ATLAS S183 experiment flight model No.2 are presented. A geometric study for the visual field setting on the grating, a photoelectric study for the passband determination of the specrophotometer and an artificial star photometric calibration of the complete instrument were performed. Test procedures are described and results given in tabular/graphical form. Equipment testing in clean room and personnel training are mentioned. Necessary improvements and problems encountered are discussed. References are given to calibration equipment and calibration procedure manuals. ESRO

N74-11099# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF CONDENSATION PHENOMENA IN THE ISL LASER WIND TUNNEL USING LIGHT DIFFUSION [UNTERSUCHUNG DER KONDENSATION IM LASER-WINDKANAL DES ISL DURCH LICHTSTREUUNG]
H. Mach 7 Nov. 1972 25 p refs In GERMAN
(Contract DRME-72/545)
(ISL-RT-19/72) Avail: NTIS HC $3.25

The condensation resulting from sudden cooling behind the Laval nozzle in a supersonic wind tunnel was investigated by means of CO2 laser light scattering. For quantitative analysis, the scattered light having an angle of 90 deg relative to the primary radiation, was measured. The medium was dried air under different pressures (20-300 torr working pressure) and two different mixtures of CO2/N2/He. the wavelength and polarization of the scattered radiation point at relatively large scattering particles with rapid growth. Comparsion of measurements leads to the conclusion that the condensation consists of residual water, and not CO2, which indicates the presence of moisture notwithstanding evacuation of the gas container. ESRO

N74-11100# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
VIBRATION SENSOR CALIBRATION AT LRBA [L'ETALONNAGE DES CAPTEURS DE VIBRATIONS AU LRBA]
19 Jun. 1973 10 p In FRENCH
(LRBA-NT-7/73/SEV) Avail: NTIS HC $3.00

A review of vibration sensor calibration is presented. Emphasis is laid on vibration simulator presentation and specification of the utilization ranges. Continuous acceleration calibration is described within geopotential and with a centrifuge machine. Extremely low frequency calibration is performed either on a linear or angular table. Medium frequency calibration is described in terms of absolute or comparative calibration. ESRO

N74-11101# Army Construction Engineering Research Lab., Champaign, Ill.
KEYED JOINT PERFORMANCE UNDER HEAVY LOAD AIRCRAFT
John L. Rice Aug. 1973 16 p refs Sponsored by Army
(AD-766706; CERL-TM-S-13) Avail: NTIS CSCL 13/2

The poor performance of keyed longitudinal construction joints in rigid airfield pavements under simulated C-5A traffic operations is presented. The data presented were collected from a full scale test track pavement supported on a low strength subgrade. No deficiencies in materials or construction were found which would have adversely affected the performance of the keyed joint. The failures observed in the keyed joint demonstrate that a balanced design will result using the Corps of Engineers keyed joint dimensions. Author (GRA)

N74-11102# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE BEHAVIOR OF FLEXIBLE AIRFIELD PAVEMENTS UNDER LOADS: THEORY AND EXPERIMENTS Technical Report, 1 Apr. 1971 - 1 Apr. 1973
Y. T. Chou and R. H. Ledbetter Jul. 1973 181 p refs
(AF Proj.-683M)
(AD-766480; AFWL-TR-72-215) Avail: NTIS CSCL 01/2

The instrumentation data of the multiple-wheel heavy gear load (MWHGL) tests were reduced and analyzed. By incorporating the performance of test pavements under traffic, relations between load and pavement response were established. A method was developed to compute the measured stresses and deflections of the test pavements; based on the method, the stresses and deflections can be computed for similar types of airfield pavements under different loads. Correlations were established between computed parameters and traffic performance data from the MWHGL test section as well as from many other pavement tests conducted by the Corps of Engineers. Based on the instrumentation data, the principle of superposition was found to be valid for flexible pavements. Attempts were made to reevaluate the equivalent single-wheel loads for MWHGLs by many different methods. Author (GRA)

N74-11103# Air Force Weapons Lab., Kirtland AFB, N.Mex.
PROCEDURES FOR CONDUCTING THE AIR FORCE WEAPONS LABORATORY STANDARD SKID RESISTANCE TEST Technical Report, 5 Feb. 1971 - 31 Jun. 1973
George D. Ballentine and Phil V. Compton Sep. 1973 102 p refs
(AD-766891; AFWL-TR-73-165) Avail: NTIS CSCL 01/5

Detailed procedures for conducting the standard runway skid resistance test are included for use in implementing an Air Force-wide skid resistance testing program. Each step in the testing procedure, ranging from calibration of the test equipment to recording of field data is discussed. Copies of all special forms required for recording data are included. Use of these forms greatly facilitates the use of computer analysis package, which has been prepared to analyze data gathered in the standard test. When the test is conducted according to procedures in this report, a great deal of information is gained about the hydroplaning potential of the runway surface. The test, therefore, represents a significant advance in the state-of-the-art of measuring runway skid resistance. Results of the test indicate directly if corrective action is required to improve runway skid resistance properties, thereby giving information unavailable from any other source. Author (GRA)

N74-11542 Technischen Universitaet, Munich (West Germany). Inst. fuer Raumfahrttechnik.
MAGNETOGASDYNAMIC PLASMA COMPRESSION FOR PARTICLE ACCELERATION FOR THE SIMULATION OF MICROMETEOROIDS [MAGNETOGASDYNAMISCHE KOMPRESSION EINES PLASMAS ZUR BESCHLEUNIGUNG VON TEILCHEN FUER DIE SIMULATION VON MIKROMETEORIDEN]
Eduard Igenbergs *In* DGLR Magnetofluiddyn. May 1973 p 75-122 refs In GERMAN (For availability see N74-11537 02-25)

N74-11681* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODEL SUPPORT ROLL BALANCE AND ROLL COUPLING
Roy E. Sharpes and William J. Carroll *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 155-163 (For availability see N74-11667 02-31)
CSCL 22B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-11104 California Univ., Los Angeles.
SPATIAL STABILITY AND TRANSITION IN COMPRESSIBLE

FLAT PLATE FLOWS Ph.D. Thesis
Gerlina Louise Keltner 1973 233 p
Avail: Univ. Microfilms Order No. 73-13139

The spatial stability of compressible flat plate flow is considered along with the prediction of the beginning of transition of such flows. The stability problem is solved for small disturbances and a parallel mean flow; only the linearized problem is considered. The undisturbed mean flow is obtained from the standard compressible boundary layer equations using a five-point Lagrangian finite difference scheme. Perfect gas fluid properties, Sutherland's law of viscosity and constant Prandtl number, are assumed. The stability characteristics of the compressible mean flow were computed first from the incompressible Orr-Somerfeld equation (neglecting the effects of temperature and fluid property fluctuations), and second from the complete set of four linear compressible stability equations. Dissert. Abstr.

N74-11105 Colorado State Univ., Fort Collins.
CONVECTIVE VELOCITIES IN THE TURBULENT BOUNDARY LAYER Ph.D. Thesis
William Chester Cliff 1972 165 p
Avail: Univ. Microfilms Order No. 73-13025

A physical model is presented which describes convective velocities within a flat plate turbulent boundary layer. A production zone with visualization techniques is used as a basis for the physical model. The production zone concept employs the idea that packets of turbulent fluid are generated near the viscous sublayer. These packets are found to be discernible from the mean motion and may move either outward from the production zone or inward depending on their circulation relative to the fluid surrounding the packet. The packets are predicted to travel with a convective velocity different from the local mean velocity throughout most of the boundary layer. The model also predicts that the convective velocities will be functions of wave number outside of the production zone. The model predicts that the convective velocity profile approaches the mean velocity profile after a finite length or time period. Experimental results are presented which agree with the predictions of the model.
Dissert. Abstr.

N74-11106 Illinois Inst. of Tech., Chicago.
ON INSTABILITIES AND SECONDARY MOTIONS IN SWIRLING FLOWS THROUGH ANNULI Ph.D. Thesis
Hassan M. Nagib 1972 243 p
Avail: Univ. Microfilms Order No. 73-12224

Initially laminar, fully-developed flows through annular passages of different radius ratios with rotating walls are investigated experimentally in water using hot-film anemometry and various visualization techniques. The first phase of the study deals with the case of solid body rotation and was performed in a specially constructed apparatus in which the annulus radius ratio was varied. In the second phase of the study the general case of differential rotation was examined in another apparatus which was constructed with a fixed radius ratio. A complementary calibration tunnel was developed during the course of the study for the detailed examination of hot-film anemometry. This led to precision measurement techniques capable of automatic compensation for water temperature variations with high frequency response. The conditions for the instability of the primary flow, the presence and character of secondary flows and the boundaries of the onset of turbulent bursts and of the region of transition to turbulence were established. Dissert. Abstr.

N74-11107 Vanderbilt Univ., Nashville, Tenn.
AN EXPERIMENTAL INVESTIGATION OF PLANE TURBULENT COUETTE FLOW WITH ADVERSE PRESSURE GRADIENTS Ph.D. Thesis
Larry Joe Huey 1972 180 p
Avail: Univ. Microfilms Order No. 73-14515

An analytical solution and an experimental investigation of plane turbulent Couette flow with imposed adverse pressure gradients are presented. The analytical results are a numerical solution to Reynolds' lubrication equations utilizing the mixing length concept to define the turbulent shear stress. A new formulation for the mixing length is used, and it is shown to yield results which are in good agreement with the experimental data for velocity profiles and friction coefficients. The experimental investigation is concerned with the case of zero net flow, i.e., the flow with an average velocity of zero across the channel. Experimental data are presented for velocity profiles, friction coefficients, the ratio of wall shear stresses, RMS velocity fluctuations, turbulent intensities, time scales, and turbulence spectra. These quantities are found to compare well with theory, where applicable. Dissert. Abstr.

N74-11108 Wisconsin Univ., Madison.
TRANSPORT PHENOMENA IN VARIABLE-PROPERTY BOUNDARY LAYERS Ph.D. Thesis
Ke-Tien Liu 1972 228 p
Avail: Univ. Microfilms Order No. 73-2552

Peturbation analyses are given for the effects of physical property variations and net interfacial mass flux on heat and mass transfer rates by forced-convention in laminar boundary layers. The analyses include multicomponent fluids and fixed and mobile three-dimensional interfaces. The variations of all relevant properties with temperature and composition are included. The analyses deal mainly with high Prandtl and Schmidt numbers and/or short contact times. A perturbation analysis for lower Prandtl or Schmidt numbers (down to about unity) on a flat plate is included. An important feature arises from these perturbation anases for pure fluid heat transfer or isothermal binary diffusion, the heat or mass transfer rate can be accurately predicted from the constant property method by assuming the fluid properties constant at some reference temperature or concentration. Dissert. Abstr.

N74-11109 Oklahoma State Univ., Stillwater.
COMPUTATION OF THE SPECTRA OF TURBULENT BOUNDARY LAYER SURFACE-PRESSURE FLUCTUATIONS Ph.D. Thesis
John H. Linebarger 1972 156 p
Avail: Univ. Microfilms Order No. 73-15180

Two contributions to the calculation of pressure spectra are made. First, the analysis of Hodgson is reworked to include an anisotropy of the integral turbulence scales. The closed form nature of the solution is preserved and the results are presented as a one-parameter family of curves. The second contribution is a more complete and accurate calculation of the wave number spectra. The wave number equation for the wall-pressure fluctuations is solved with a Monte Carlo numerical integration scheme. This allows the integrand to be modeled with empirical data. The mean-shear gradient, the turbulent intensity, and certain anisotropic characteristics of the flow are allowed to vary across the boundary layer. With this technique, a one-parameter family of wave number spectra is computed. Taylor's hypothesis is applied to the result to predict the frequency power spectrum. Dissert. Abstr.

N74-11110 Iowa Univ., Iowa City.
UNSTEADY COMPRESSIBLE BOUNDARY LAYER FLOWS WITHIN A CENTERED EXPANSION WAVE AND BEHIND A STRONG PLANE BLAST WAVE Ph.D. Thesis
Lang-Mann Chang 1972 120 p
Avail: Univ. Microfilms Order No. 73-13511

Analyses are made for two kinds of unsteady, compressible, laminar, two-dimensional boundary layer flows. One is the flow within a centered expansion wave and the other, behind a strong plane blast wave. The free stream flow external to the boundary layer is assumed to be one-dimensional and inviscid. The solutions of the free stream are used as the outer boundary conditions of the boundary layer flows. Two extreme wall conditions, namely, isothermal wall and adiabatic wall are considered. The viscosity of the fluid is assumed to be a linear function of temperature while the other properties except density remain constant throughout the flow field. The governing equations are nondimensionalized first and then a proper change of variables for the equations are made. The method of similarity transformation via one-parameter group theory is employed to reduce the number of the independent variables from three to two. Dissert. Abstr.

N74-11111 Rochester Univ., N.Y.
ON THE NEUTRAL STABILITY OF A BUOYANT FREE SHEAR LAYER Ph.D. Thesis
Bruce Lake Bauer 1972 119 p
Avail: Univ. Microfilms Order No. 73-14795

The neutral stability of a stratified, inviscid, buoyant parallel,

free shear flow to infinitesimal three dimensional disturbances is investigated by a numerical technique. The shear velocity profile is approximated by the hyperbolic tangent and the density is considered to be an exponential with a constant scale height. Three specific extensions of this model are considered. These are the effect of increased stratification, a parallel magnetic field, and compressibility. Dissert. Abstr.

N74-11112 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TURBULENT BOUNDARY LAYER GROWTH AT HYPERSONIC SPEEDS
J. L. Stollery May 1973 20 p refs
(IC-AERO-73-04) Avail: Issuing Activity

Starting from the momentum integral equation, simple relations for all the gross features of a turbulent boundary layer at hypersonic speeds, such as Stanton number and skin friction coefficient, were derived. These relations show explicitly the dependence on the hypersonic viscous interaction parameter, the wall temperature ratio, and the pressure gradient. The analysis was repeated for laminar flow and of the results with existing well-established relations showed agreement. ESRO

N74-11113*# Advanced Technology Labs., Inc., Westbury, N.Y.
ANALYSIS AND DESIGN OF THREE DIMENSIONAL SUPERSONIC NOZZLES. VOLUME 1: NOZZLE-EXHAUST FLOW FIELD ANALYSIS BY A REFERENCE PLANE CHARACTERISTICS TECHNIQUE
S. Dash and P. DelGuidice Oct. 1972 197 p refs
(Contract NAS1-10327)
(NASA-CR-132350; ATL-TR-166-Vol-1) Avail: NTIS HC $12.00 CSCL 20D

A second order numerical method employing reference plane characteristics has been developed for the calculation of geometrically complex three dimensional nozzle-exhaust flow fields, heretofore uncalculable by existing methods. The nozzles may have irregular cross sections with swept throats and may be stacked in modules using the vehicle undersurface for additional expansion. The nozzles may have highly nonuniform entrance conditions, the medium considered being an equilibrium hydrogen-air mixture. The program calculates and carries along the underexpansion shock and contact as discrete discontinuity surfaces, for a nonuniform vehicle external flow. Author

N74-11114*# Advanced Technology Labs., Inc., Westbury, N.Y.
ANALYSIS AND DESIGN OF THREE DIMENSIONAL SUPERSONIC NOZZLES. VOLUME 2: NUMERICAL PROGRAM FOR ANALYSIS OF NOZZLE-EXHAUST FLOW FIELDS
P. Kalben Oct. 1972 175 p
(Contract NAS1-10327)
(NASA-CR-132351; ATL-TR-166-Vol-2) Avail: NTIS HC $10.75 CSCL 20D

The FORTRAN IV Program developed to analyze the flow field associated with scramjet exhaust systems is presented. The instructions for preparing input and interpreting output are described. The program analyzes steady three dimensional supersonic flow by the reference plane characteristic technique. The governing equations and numerical techniques employed are presented in Volume 1 of this report. Author

N74-11115*# Advanced Technology Labs., Inc., Westbury, N.Y.
ANALYSIS AND DESIGN OF THREE DIMENSIONAL SUPERSONIC NOZZLES. VOLUME 3: A DESIGN TECHNIQUE FOR MULTIPLE NOZZLE CONFIGURATIONS
A. Ferri Oct. 1972 24 p
(Contract NA61-10327)
(NASA-CR-132352; ATL-TR-166-Vol-3) Avail: NTIS HC $3.25 CSCL 20D

An iteration procedure for optimum nozzle design with application to hypersonic aircraft is discussed. In the procedure, intial values of several of the design parameters are assumed from simplified approximate considerations and are then varied systematically in order to determine the value of each parameter which optimizes nozzle performance. Improvements in nozzle performance are obtained by perturbing the initially assumed values of the geometric parameters on the basis of a computer analysis. Author

N74-11116*# Advanced Technology Labs., Inc., Westbury, N.Y.
ANALYSIS AND DESIGN OF THREE DIMENSIONAL SUPERSONIC NOZZLES. VOLUME 4: SIMILARITY LAWS FOR NOZZLE FLOWS
A. Ferri and G. Roffe Oct. 1972 31 p refs
(Contract NAS1-10327)
(NASA-CR-132353; ATL-TR-166-Vol-4) Avail: NTIS HC $3.75 CSCL 20D

The development of nozzles for hypersonic aircraft is discussed. The simulation of actual nozzle flows with low temperature nonreactive gases is described. Mathematical models of the flow equations nd thermodynamic relations are developed. Cold flow simulation tests were conducted and the results are included. Author

N74-11117# Raytheon Co., Bedford, Mass. Missile Systems Div.
ANALYSIS OF GAS-SOLID PARTICLE FLOWS IN SHOCK TUBES
Bernard Otterman (Cabot Corp., Billerica, Mass.) and Andrew S. Levine 2 Nov. 1973 37 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA journal in Apr. 1974 Prepared in cooperation with Northeastern Univ.
Avail: NTIS HC $4.00

The behavior of suspensions in shock tubes is analyzed by means of a Particle-in-Cell (PIC) calculation method that incorporates heat and drag interaction between phases. The results of the particle in cell calculation are shown to agree with the predictions of the shock tube equations when the latter are applied to an equivalent gas defined in terms of the properties of the suspension. The shock location, which depends on the transient phenomena, AIAA Journal in Apr. 1974 Prepared in cooperation with and, therefore, cannot be predicted using the shock tube equations, can readily be determined using the calculation method described. In an investigation of the transient behavior of suspensions in shock tubes, the errors arising from the use of too large a cell length are demonstrated; in particular, the temperatures in the shock-heated portion of the flow are in error due to the influence of the shock and contact discontinuities. Author

N74-11118*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
ANALYSIS OF STRATIFIED AND CLOSELY SPACED JETS EXHAUSTING INTO A CROSSFLOW
H. Ziegler and P. T. Woller Nov. 1973 117 p refs
(Contract NAS1-11524)
(NASA-CR-132297; NOR-73-77) Avail: NTIS HC $8.00 CSCL 20D

Procedures have been developed for determining the flow field about jets with velocity stratification exhausting into a crossflow. Jets with three different types of exit velocity stratification have been considered: (1) jets with a relatively high velocity core; (2) jets with a relatively low velocity core; and (3) jets originating from a vaned nozzle. The procedure developed for a jet originating from a high velocity core nozzle is to construct an equivalent nozzle having the same mass flow and thrust but having a uniform exit velocity profile. Calculations of the jet centerline and induced surface static pressures have been shown to be in good agreement with test data for a high velocity core nozzle. The equivalent ideal nozzle has also been shown to be a good representation for jets with a relatively low velocity core and for jets originating from a vaned nozzle in evaluating jet-induced flow fields. For the singular case of a low velocity core nozzle, namely a nozzle with a dead air core, and for the vaned nozzle, an alternative procedure has been developed. The internal mixing which takes place in the jet core has been properly accounted for in the equations of motion governing the jet development. Calculations of jet centerlines and induced surface static pressures show good agreement with test data these nozzles. Author

N74-11119*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONTROL OF SUPERSONIC WIND-TUNNEL NOISE BY LAMINARIZATION OF NOZZLE-WALL BOUNDARY LAYER
Ivan E. Beckwith, William D. Harvey, Julius E. Harris, and Barbara B. Holley Washington Dec. 1973 58 p refs
(NASA-TM-X-2879; L-9090) Avail: NTIS HC $3.50 CSCL 20D

One of the principal design requirements for a quiet supersonic or hypersonic wind tunnel is to maintain laminar boundary layers on the nozzle walls and thereby reduce disturbance levels in the test flow. The conditions and apparent reasons for laminar boundary layers which have been observed during previous investigations on the walls of several nozzles for exit Mach numbers from 2 to 20 are reviewed. Based on these results, an analysis and an assessment of nozzle design requirements for laminar boundary layers including low Reynolds numbers, high acceleration, suction slots, wall temperature control, wall roughness, and area suction are presented. Author

N74-11120# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
METHOD FOR LINEARIZING HOT FILM SIGNALS WITH THE PDP-15 DIGITAL COMPUTER AND APPLICATION TO MEASUREMENTS IN A TURBULENT CHANNEL FLOW [EINE METHODE ZUR LINEARISIERUNG VON HEISSFILMSIGNALEN MIT DEM DIGITALRECHNER PDP-15 UND IHRE ANWENDUNG BEI MESSUNGEN IN EINER TURBULENTEN KANALSTROEMUNG]
Hans-Peter Kreplin 1973 88 p refs In GERMAN
(Rept-2/1973) Avail: NTIS HC $6.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 22,60 DM

A digital method for linearization of signals from hot-film flowmeter is proposed and applied to one-component measurements in a turbulent channel flow. A PDP-15 digital computer was used for data processing and evaluation purposes. The measurements were carried out in an oil channel. The results agree with those obtained in the same channel by an analog method. The distribution of skewness and flatness factors of the longitudinal variations over half channel width were also determined. The computer programs, and examples of applications, are attached. ESRO

N74-11121# Technische Hogeschool, Delft (Netherlands). Lab. of Fluid Mechanics.
CAVITATION CAUSED BY WATER HAMMER IN HORIZONTAL PIPELINES
J. P. T. Kalkwijk, C. Kranenburg, C. B. Vreugdenhil, and A. H. DeVries Mar. 1972 38 p refs Prepared jointly with Waterloopkundig Lab.
(Publ-97) Avail: NTIS HC $4.00

Mathematical models and computer programs were developed in order to calculate cavitation caused by water hammer in a horizontal pipeline in which a certain drop in the pressure-head occurs at the upstream and linearly with the time. Both models and computer programs were compared. Moreover, for many values of dimensionless coefficients, calculations were made with both computer programs, and their results and compared. (ESRO)

N74-11122# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
PRESSURE LOSSES THROUGH SCREENS
A. Dadone and M. Napolitano (Bari Univ.) Jul. 1973 28 p refs
(Contract CNR-115.4075.69-01220)
(Publ-146) Avail: NTIS HC $3.50

Wire screen or gauze placed in many duct systems, such as reciprocating engines and pulse-type supercharger manifolds influence pressure wave propagation and, therefore, system performance. Steady flow pressure losses through five commercial screens are presented. Theories and experimental results are compared. A new theoretical-empirical method was developed and was verified to predict 91% of all existing data within 5%. ESRO

N74-11123# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
PRESSURE WAVE PROPAGATION THROUGH SCREENS PLACED IN A DUCT [PROPAGAZIONE DI ONDE DI PRESSIONE ATTRAVERSO RETI INTUBATE CON FLUSSO PREESISTENTE]
A. Dadone and M. Napolitano (Bari Univ.) Jul. 1973 28 p refs In ITALIAN; ENGLISH summary
(Contract CNR-115.4075.69-01220)
(Publ-147) Avail: NTIS HC $3.50

Reflected and transmitted pressure waves take place when an incident pressure wave reaches a screen placed in a duct and crossed by a previous steady flow. The thickness of the screen is assumed to be negligible and pressure losses through it in the quasi steady flow, which takes place after the passage of the incident pressure wave, are assumed to be steady flow ones. The strength of reflected and transmitted pressure waves is related to the strength of the incident wave, the porosity of the screen, and the previous flow through it. Subsonic and just supersonic quasi steady flow in-side the screen are considered. Five commercial screens were tested with incident shock waves and the experimental results were compared with the theoretical ones: the agreement is quite satisfactory. Author (ESRO)

N74-11124# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.
TURBULENT TRANSPORT IN COMPRESSIBLE FLOWS Final Scientific Report, 1 Feb. 1972 - 30 Jun. 1973
Alexander Favre Jul. 1973 23 p refs
(Contract F44620-72-C-0056; AF Proj. 9781)
(AD-766950; AFOSR-73-1630TR; SR-9) Avail: NTIS CSCL 20/4

Statistical equations for a turbulent compressible gas are given with some comments: (a) for the correlation of the fluid density and two transportable quantities, in a generalized form, the complete definition where the non random parts of the turbulent quantities are kept free, and at a later stage in a form which is simpler where the non random parts of the extensive quantities are defined by the mean mass-weighted values; (b) for the mean turbulent fluxes of a transportable quantity; (c) for the Reynolds stresses, for the turbulent fluxes of vorticity, for the turbulent flow of internal energy, enthalpy and heat, for turbulent fluxes of entropy, for turbulent fluxes of components of a binary mixture; (d) for the correlation of the fluid entropy and vorticity. Author (GRA)

N74-11125# Naval Ship Research and Development Center, Bethesda, Md.
HYDRODYNAMIC FORCES ON OSCILLATING AND NONOSCILLATING SMOOTH CIRCULAR CYLINDERS IN CROSSFLOW Final Report
David W. Coder Oct. 1972 91 p refs
(AD-767022; NSRDC-3639) Avail: NTIS CSCL 20/4

A 12-in-diameter, 6-ft-long cylinder was towed horizontally 4 ft beneath the water surface and perpendicular to the flow. The cylinder was towed at a constant velocity under the following conditions: nonoscillating, oscillating in heave, oscillating in pitch (around the axis of the cylinder), and simultaneously oscillating in pitch and heave. Experimental data on lift, drag, and moment were obtained for Reynolds number from about 100,000 to above 1 million. The results show that the oscillations can significantly influence the magnitude of the lift, drag, and moments. Author (GRA)

N74-11126# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE NUMERICAL SOLUTION OF THE FLUID DYNAMICAL EQUATIONS IN CURVILINEAR COORDINATES Technical Report, Oct. 1972 - Jun. 1973
Peter R. Eiseman Aug. 1973 90 p refs
(AF Proj. 3326)
(AD-766697; AFWL-TR-73-172) Avail: NTIS CSCL 20/4

Most of the practical fluid dynamic problems result in studies of flows which are constrained to curved boundaries. Such boundaries may even have some sharp corners. To circumvent certain computational difficulties, one must transform the governing equations of motion into a coordinate system where the boundaries are simple. Among the most useful transformations are those which are constructed from analytic functions and from simple homotopies. In essence, the simplified boundaries are obtained at the expense of having a slightly more complicated system of equations. This slight complication offers very little resistance to a numerical solution. A numerical method is then

developed to efficiently solve the transformed equations. The numerical scheme is a hybrid of the methods of Lax-Wendroff and MacCormack which is adapted to accommodate source terms. In particular, this time-dependent procedure has two steps which follow the non-centered pattern of MacCormack's method where the fluxes are adjusted in such a way that second derivatives are handled in the well-centered manner characteristic of the Lax-Wendroff method. Author (GRA)

N74-11127# Naples Univ. (Italy).
UNIFIED FUNCTIONAL APPROACH TO THE SOLUTION OF FORMALLY ADJOINT PROBLEMS OF CONTINUUM MECHANICS Final Scientific Report
Luigi G. Napolitano Dec. 1972 55 p refs
(Contract F61052-68-C-0035)
(AD-766949; IA-180; AFOSR-73-1631TR) Avail: NTIS CSCL 20/4

The report presents and discusses a unified functional approach for the solution of problems of continuum mechanics which are governed by formally adjoint linear differential operators. It is first shown that the exact solutions of the subject problems constitute the unique element common to two dual linear manifolds parallel to two orthogonal subspaces of a suitably defined Hilbert space. Subsequently dual and reciprocal variational principles are formulated, bounds for the exact solutions are derived and error estimates for approximate solutions are obtained. The analysis is carried out and the results established for a formally adjoint linear differential operator of arbitrary even order. More detailed presentation and further elaboration of the more relevant aspects of the general theory are given in an Appendix in connection with the particular case of a second order operator. The unified theory presented has many practical and important implications both from a general and a computational point of view. For instance, it allows, one to establish that such known theorems of structural mechanics as Betti, Castigliano, Clapeyron, Pasternak theorems hold for all linear formally adjoint problems irrespective of the particular field of continuum mechanics they belong to. Author (GRA)

N74-11128# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
THE STABILITY OF HELICAL VORTEX FILAMENTS IN THE WAKE OF A HOVERING ROTOR
Ojars Skujins and Richard E. Walters May 1973 143 p refs
(Contract N00014-68-A-0512; NR Proj. 215-163)
(AD-766828; TR-36) Avail: NTIS CSCL 20/4

An experimental investigation was performed to study the geometry and stability of the wake of a hovering rotor out of ground effect. A schlieren system in conjunction with a high speed drum camera was developed for this purpose, so that real-time sequence photographs could be taken of the vortex filaments as they were convected downstream. Two, three, and four bladed 16-inch diameter rotors were used operating at rotor speeds of up to 9000 RPM. The effects of a rotor speed, number of blades, and collective pitch, were correlated with the stability of the vortex wake system. Four modes of vortex filament instabilities were observed. Other topics discussed are the effect of rotor blade mismatching upon the performance of the rotor; and the effect of rotor blade tip modifications upon the trailing vortex formation and performance of the rotor system. Blade tips of elliptical, square and ogee designs were investigated. Schlieren pictures are included from both studies. (Modified author abstract) GRA

N74-11129# Naval Ordnance Lab., White Oak, Md.
TURBULENCE MEASUREMENTS WITH A LASER DOPPLER VELOCIMETER
William J. Yanta 1 May 1973 85 p refs
(AD-766781; NOLTR-73-94) Avail: NTIS CSCL 20/4

Turbulence measurements with a Laser Doppler Velocimeter (LDV) using the dual scatter or differential Doppler mode have been made in a subsonic, fully developed channel flow. The measurements were made using only those light scattering particles occurring naturally in air. Results include mean velocity profiles, turbulence intensities, Reynolds stress distributions and a skewness measurement of the velocity distribution function across the channel. Statistical techniques were used to obtain the various turbulence parameters. Guidelines have been established for the amount of data needed to obtain results with a specified accuracy and confidence level. Measurements have also been made to determine the particle-size distribution. An aerodynamic means was used to determine the size distribution, in contrast to the usual optical procedures. (Modified author abstract) GRA

N74-11130# Alabama Univ., Huntsville. School of Graduate Studies and Research.
APPLICATION OF NUMERICAL TECHNIQUES TO TRANSONIC FLOW FIELD ANALYSIS Final Technical Report, Dec. 1971 - Mar. 1973
Jerome J. Brainerd and Min Shih 5 Mar. 1973 104 p refs
(Contract DAAH01-72-C-0406)
(AD-766772) Avail: NTIS CSCL 20/4

A study was made of methods for computation of transonic flow about bodies of revolution. Of the many methods developed for various fluid mechanical problems, only a few have been even marginally successful in calculating transonic flow fields. The relaxation procedures of Krupp and Murman and of Bailey appear to be the only programs available in the U.S. which satisfactorily treat axially symmetric transonic flows. These two methods are similar, with differences in grid and imposition of boundary conditions. Several comparative calculations were run with the two programs for a simple body of revolution and for a variety of choices of grid and location of the inner grid boundary. (Modified author abstract) GRA

N74-11131# Martin Marietta Corp., Denver, Colo.
MIXING INVESTIGATION OF HYDROGEN AND SUPERSONIC FLUORINE FLOWS Technical Report, 19 Jan. 1972 - 1 Feb. 1973
Stewart G. Chapin Jun. 1973 179 p refs
(Contract F29601-72-C-0044)
(AD-766754; AFWL-TR-72-242) Avail: NTIS CSCL 20/4

Experimental data from two shock tube/shock tunnel facilities capable of simulating the operational conditions of continuous flow chemical laser devices are presented. One facility is specifically designed for reproducing the reaction mixing region developed when hydrogen is injected through various sonic ports into a supersonic fluorine carrying stream; the other facility simulates the parallel shear layer mixing developed between a supersonic fluorine carrying stream and an adjacent supersonic hydrogen carrying stream. Established experimental techniques, including the Mach-Zehnder interferometer, rapid scanning infrared spectrometer, pitot pressure probes, and thermocouple temperature probes, have been employed to map flow conditions within the test section mixing layer. A theoretical model of the parallel shear flow turbulent mixing region is described and results from this model are compared with measured monochromatic fringe-shift profiles. Reasonably good agreement has been demonstrated between theoretical predictions and the experimental profiles for two widely different experimental situations. Author (GRA)

N74-11132# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
PREDICTION OF THE TURBULENT BOUNDARY LAYER SEPARATION
Fang-Kuo Chou and Virgil A. Sandborn Jul. 1973 114 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414)
(AD-766845; CER73-74FKC-VAS3; THEMIS-CER-TR-22) Avail: NTIS CSCL 20/4

A method for the prediction of the location of turbulent boundary layer separation is developed, based on an inner and outer velocity distributions technique and a separation criterion which applies directly to the separation position. For the inner region, the model employs empirical one-parameter boundary layer separation profiles. For the outer region the equivalent velocity distribution for the flow on a flat plate has been used. The resulting formula for predicting the separation position is a simple nonlinear algebraic equation. The method is tested by comparing with several well documented separation measurements. The results show good agreement. An experimental study for a turbulent boundary layer up to and through the separation region has been made to further demonstrate the method. (Modified author abstract) GRA

N74-11133# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF HYPERSONIC BOUNDARY LAYER WITH INJECTION OF LIQUID COOLANT
I. G. Druker and L. Ya Treer 22 Aug. 1973 10 p refs Transl. into ENGLISH from Tr. Akad. Nauk Belorussk. SSR, Inst. Teplo- i Massoobmena (Minsk); v. 1, 1972 p 167-170
(AD-766568; FTD-HT-23-038-74) Avail: NTIS CSCL 20/4

Much attention has been devoted to the calculation of multicomponent boundary layers with the presence of coolant injection. The majority of it examines injection of a gaseous coolant, which introduces new components inside the boundary layer leading to a decrease of heat transfer coefficients and heat flows. Some works investigate heat exchange in the presence of a liquid film on the surface of the body. Such a film can appear during the partial melting of the surface or from injection of a liquid coolant. In this work in exact formulation, there is studied the effect of the distributed feed of liquid coolant on flow and heat exchange in the vicinity of the critical point. GRA

N74-11134# Naval Ship Research and Development Center, Bethesda, Md.
SIMILARITY LAWS FOR TURBULENT FLOW OF DILUTE SOLUTIONS OF DRAG-REDUCING POLYMERS
T. T. Huang Aug. 1973 42 p refs
(ZF61412)
(AD-766787; NSRDC-4096) Avail: NTIS CSCL 20/4

Velocity similarity laws, based on a four-layer, mean-velocity-profile model are deduced for turbulent boundary layers with dilute polymer solutions by means of pipe-flow experiments. Measured drag reduction is studied in three domains: undersaturated, optimal, and oversaturated. Drag reduction increases with increasing concentration in the undersaturated domain where the four-layer profile exists in the boundary layer. The boundary between the two domains gives optimal drag reduction; it is determined by the polymer type and concentration and by a Reynolds number based on shear velocity and boundary-layer thickness. The effects of solvent temperature, pipe diameter, polymer type and concentration, and wall shear stress on the measured drag reduction have been investigated. (Modified author abstract) GRA

N74-11229 Tokyo Univ. (Japan). Ocean Research Inst.
A SHIPBORNE WAVE-RECORDING SYSTEM WITH DIGITAL DATA PROCESSING
K. Taira, A. Takeda, and K. Ishikawa (Min. of Posts and Telecommun.) *In* WMO Means of Acquisition and Commun. of Ocean Data Vol. 2- 1973 p 116-125 refs (For availability see N74-11219 02-13)

N74-11233 Massachusetts Inst. of Tech., Cambridge.
UNDERWAY AND SCANNING MEASUREMENT OF AIR-SEA SURFACE LAYER PROPERTIES
E. Mollo-Christensen and P. Koziol *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2- 1973 p 170-185 refs (For availability see N74-11219 02-13)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-11135 Pennsylvania State Univ., University Park.
APPLICATION OF MULTISPECTRAL REMOTE SENSING AND SPECTRAL REFLECTANCE PATTERNS TO SOIL SURVEY RESEARCH Ph.D. Thesis
Harold Lynn Mathews 1972 119 p
Avail: Univ. Microfilms Order No. 73-14022

Spectral reflectance curves of selected soil characterization samples and standard clay minerals were studied over the wavelength interval 0.5 to 2.6 microns. Results reported include reflectance data from three Hagerstown profiles and the Ap horizons of a Berks, Penn, and Ellery profile. Hagerstown soils are developed from limestone: while the Berks, Penn, and Ellery are developed from shale, sandstone, and glacial till respectively. Spectral curves for standard clay mineral samples of montronite, kaolinite, and illite were also studied. Spectral reflectance data indicate that clay type and the amount of organic matter, Fe_2O_3, and silt influence the intensity of energy reflected by soils in the 0.5 to 2.6 micron range. High contents of organic matter and Fe_2O_3 reduced reflectance intensity in the 0.5 to 1.2 micron range, while clay type influenced curve shape and intensity over the entire range studied. For the Hagerstown profiles, silt is highly correlated with percent reflectance in the 0.8 to 2.5 micron range. Dissert. Abstr.

N74-11136 Arizona Univ., Tucson.
FLUCTUATIONS OF ATMOSPHERIC RADIOCARBON Ph.D. Thesis
Donald Carson Grey 1972 238 p
Avail: Univ. Microfilms Order No. 73-13326

The geophysical and geochemical mechanisms which cause variations in the amount of C-14 in the atmosphere are discussed. A theoretical model of the way in which solar flare and sunspot activity affect the amount of C-14 in the atmosphere was developed. The long term variations of atmospheric C-14 are explained by a model which describes the effects of varying the geomagnetic field. Seasonal variations in C-14 concentration in the troposphere are shown to be due to fluctuating tropopause height. Uptake of C-14 by the oceans is calculated and shown to be relatively large at low latitudes. Dissert. Abstr.

N74-11137 Washington Univ., Seattle.
MESOSCALE CELLULAR CONVECTION Ph.D. Thesis
Thomas Evans Rosmond 1972 115 p
Avail: Univ. Microfilms Order No. 73-13875

A linear stability model for mesoscale cellular convection in the atmosphere is developed. The model includes a forcing term which is a parameterization of the net heating due to small scale cumulus convection. A sub-cloud and cloud layer are defined. With the forcing term having non zero values only in the cloud layer. Positive static stability is assumed in both layers so that the only source of buoyant energy is the forcing term. The parameterization of latent heating due to cumulus convection is accomplished by assuming that the heating is proportional to the cloud-environment temperature difference and the vertical flux of moisture by the perturbation vertical velocity. Normal mode horizontal dependence and exponential time dependence is assumed for the vertical velocity and the forcing term is defined as proportional to the vertical velocity at the interface between the two layers. The solutions in the two layers are matched across the interface. Dissert. Abstr.

N74-11138 Pittsburgh Univ., Pa.
COLLISIONLESS MODELS OF THE ION-EXOSPHERE Ph.D. Thesis
Shaw Chen Liu 1972 115 p
Avail: Univ. Microfilms Order No. 73-13239

Collisionless models of the ion-exosphere with self consistent electric fields which insure charge neutrality are constructed. The density, temperature and pitch angle distributions of ions and electrons are calculated for a thermal plasma. In the real magnetosphere the collisionless thermal plasma models may describe the region beyond the plasmapause where field lines are still closed. Two sources of electric field parallel to the magnetic field line have been identified. One is charge polarization due to the difference of gravitational forces between ions and electrons. The other is charge polarization due to the difference in diamagnetic forces on ions and electrons. Dissert. Abstr.

N74-11139 California Univ., Los Angeles.
THE ORIGIN AND PROPAGATION OF CHORUS IN THE OUTER MAGNETOSPHERE Ph.D. Thesis
Rande Keith Burton 1973 153 p
Avail: Univ. Microfilms Order No. 73-13131

Wave normals of chorus in the outer magnetosphere were determined for the first time from data obtained with the UCLA/JPL triaxial search coil magnetometer experiment on OGO-5, which provides complete vector information on the magnetic fluctuation vector between 1 and 1000 Hz. Wave normal distributions with respect to the geomagnetic field are presented for chorus detected outside of the plasmapause in two local

time regions: (1) within four hours of local noon and, (2) within three hours of local midnight. The magnetic latitude of the measurements range from the equator to plus or minus 50 deg on the dayside and from the equator to 10 deg on the nightside. The results strongly support chorus generation by a Doppler shifted cyclotron resonance with electrons near the geomagnetic equatorial plane. Dissert. Abstr.

N74-11140 Utah State Univ., Logan.
THE INFRARED ATMOSPHERIC EMISSION OF MOLECULAR OXYGEN IN THE EQUATORIAL NIGHT SKY Ph.D. Thesis
Ruey-Yuan Han 1973 120 p
Avail: Univ. Microfilms Order No. 73-13295

A rocket was launched near the equator (5.854 deg S and 34.832 deg W) on March 9, 1969. This rocket carried a 1.27 micron photometer. The photometric observation provided vertical scans through the earth limb throughout 360 deg of azimuthal angle, and as a consequence viewed this emission, from above and over a large distance. The data obtained from this flight showed a prominent emitting layer at 80 + 5 km with a thickness of approximately 10 km. Some time-dependent calculations are made for the variation of O2(1 delta g) profile after sunset based on different physical models. All possible production and destruction reactions of O2 (1 delta g) in the nighttime are discussed in detail. The comparison of the calculated results with the measured data implies that the hydrogen reactions should have significant contribution of O2 (1 delta g)after sunset. Some possible explanations are given for the latitudinal variation of O2(1 delta g) emission. This phenomenon is crucially dependent on the concentrations of the minor constituents, O3, O, H, and OH. Dissert. Abstr.

N74-11141 Association pour le Development des Etudes Geo-Physiques et Spatiales, Verriers le Buisson (France).
LASER BEAM OPTICAL RESONANCE MEASUREMENT OF ATMOSPHERIC PARAMETERS ABOVE 80 km Final Report [MESURE DES PARAMETRES DE L'ATMOSPHERE AU-DESSUS DE 80 km PAR RESONANCE OPTIQUE D'UN FAISCEAU LASER RAPPORT FINAL]
J. E. Blamont, M. L. Chanin, and G. Megie Dec. 1972 13 p refs In FRENCH
(Contract DGRST-71-72-681)
Avail: Issuing Activity

A laser beam optical resonance experiment on Na atoms for high altitude atmospheric composition is presented. A chemical laser beam with two Fabry Perot interferometers was emitted in the atmosphere through an afocal telescope. The receiving telescope structure is detailed. Results show a stratified structure of the altitude profile and give temperature measurements between 80 and 100 km. ESRO

N74-11142*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Oct. 1973
Irvin J. Sattinger, Principal Investigator 2 Nov. 1973 2 p EREP
(Contract NAS9-13283)
(E74-10001; NASA-CR-135842; ERIM-103300-12-L) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-11143*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Progress Report, 1 Jul. - 31 Aug. 1973
Mark F. Meier, Principal Investigator 31 Aug. 1973 4 p ERTS
(NASA Order S-70243-AG-2)
(E74-10002; NASA-CR-135843) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-11144*# American Univ., Washington, D.C. Dept. of Biology.
ERTS-1 DATA USER INVESTIGATION OF WETLANDS ECOLOGY Progress Report, Jul. - Sep. 1973
Richard R. Anderson, Principal Investigator 30 Sep. 1973 10 p ref ERTS
(Contract NAS5-21752)
(E74-10003; NASA-CR-135844; PR-7) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-11145*# Maryland Geological Survey, Baltimore.
[GEOLOGICAL SURVEY OF MARYLAND USING EREP FLIGHT DATA] Quarterly Report
Kenneth N. Weaver, Principal Investigator 12 Nov. 1973 2 p EREP
(Contract NAS9-13294)
(E74-10004; NASA-CR-135845) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Underflight photography has been used in the Baltimore County mined land inventory to determine areas of disturbed land where surface mining of sand and ground clay, or stone has taken place. Both active and abandoned pits and quarries were located. Aircraft data has been used to update cultural features of Calvert, Caroline, St. Mary's, Somerset, Talbot, and Wicomico Counties. Islands have been located and catalogued for comparison with older film and map data for erosion data. Strip mined areas are being mapped to obtain total area disturbed to aid in future mining and reclamation problems. Coastal estuarine and Atlantic Coast features are being studied to determine nearshore bedforms, sedimentary, and erosional patterns, and manmade influence on natural systems.

N74-11146*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Bimonthly Progress Report, 23 Aug. - 23 Oct. 1973
Duwayne M. Anderson, H. L. McKim, R. K. Haugen, L. W. Gatto, C. W. Slaughter, and T. L. Marlar, Principal Investigators 23 Oct. 1973 3 p refs ERTS
(NASA Order S-70253-AG)
(E74-10005; NASA-CR-135846; BMPR-6) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N74-11147*# Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Progress Report, 1 Sep. - 1 Nov. 1973
P. N. Slater, Principal Investigator, R. L. Antos, and R. A. Schowengerdt Nov. 1973 2 p ERTS
(Contract NAS5-21849)
(E74-10006; NASA-CR-135847; PR-7) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N74-11148*# Texas Instruments, Inc., Dallas. Services Group.
ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF THE COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Interim Report, 1 Mar. - 31 Aug. 1973
D. F. Saunders, Principal Investigator, G. Thomas, and F. E. Kinsman Sep. 1973 37 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21796)
(E74-10007; NASA-CR-135848; U1-702700-2) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Five areas of North America (North Slope, Alaska; Superior

Province, Canada; Williston Basin, Montana; Colorado; and New Mexico-West Texas) are being studied for discernibility of geological evidence on ERTS-1 imagery. Evidence mapped is compared with known mineral/hydrocarbon accumulations to determine the value of the imagery in commercial exploration programs. The conclusion is that there is a great advantage in photogeologic interpretation from the satellite viewpoint to provide a truly synoptic examination of regional geologic features. In addition to detecting lineaments which may be continental in scale, many large circular or curvilinear tonal or dissection patterns not generally detected on conventional aerial photos have been discovered. Preliminary analysis of these lineaments and curvilinear anomalies has established close empirical relationships between these features and both mineral deposits and the structure of sedimentary basins. Details are presented of the Colorado region interpretation.

N74-11149*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 31 Oct. 1973
Roland S. Yunghans, Edward B. Feinberg, Frank J. Wobber, Robert L. Mairs, Principal Investigators, Robert T. Macomber, and Dennis Stanczuk 9 Nov. 1973 14 p Prepared for N. J. Dept. of Environ. Protection ERTS
(Contract NAS5-21765)
(E74-10010; NASA-CR-135851) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. A Coastal Zone Surveillance Program has been developed in which systematic comparisons of early ERTS-1 images and recently acquired images are regularly made to identify areas where changes have occurred. A methodology for assessing and documenting benefits has been established. Quantification of benefits has been directed toward four candidate areas: shore protection, ocean outfalls, coastal land resources, and offshore waste disposal. A refinement in the change detection analysis procedure has led to greater accuracy in spotting developmental changes in the Coastal Zone. Preliminary conclusions drawn from the Shore Erosion case study indicate that in the northern test area (developed beach) erosion has occurred more often, is generally more severe, and the beach is slower to recover than in the southern test area (natural beach). From these data it appears that it may be possible to define areas most likely to experience further erosion. The assumption of continued erosion in areas that have at one time experienced severe erosion is supported by the simple fact that as a beach narrows wave energy is concentrated on a narrower beach surface. The higher energy condition subsequently results in accelerated erosion.

N74-11150*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Oct. 1973
Jack G. Quade, Principal Investigator Oct. 1973 2 p EREP
(Contract NAS9-13274)
(E74-10012; NASA-CR-135853) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-11151*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Oct. 1973
A. G. Mourad and D. M. J. Fubara, Principal Investigators 16 Nov. 1973 25 p refs EREP
(Contract NAS9-13276)
(E74-10013; NASA-CR-135854; PR-8) Avail: NTIS HC $3.25 CSCL 08E

There are no author-identified significant results in this report.

N74-11152*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Oct. 1973
Keenan Lee, Principal Investigator 14 Nov. 1973 5 p EREP
(Contract NAS9-13394)
(E74-10014; NASA-CR-135855) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-11153*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM Progress Report, 1 Jul. - 31 Aug. 1973
Paul Mohr, Principal Investigator 31 Aug. 1973 2 p ERTS
(Contract NAS5-21748)
(E74-10015; NASA-CR-135856) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. The new fault map of the main Ethiopian rift, based on aerial photo compilations, generally agrees well with the maps produced from ERTS-1 imagery. Characteristically, the ERTS-1 imagery shows some of the major faults to be more extensive than realized from ground studies, though due to the angle of sun illumination some east-facing fault scarps are not easily discernible on the imagery. The Corbetti caldera, shows up surprisingly poor on the imagery, and is shown to be an adjunct to an older, larger caldera now occupied by Lakes Awassa and Shallo. The lithological boundaries mapped by De Paola in the rift are difficult to discern on the ERTS-1 imagery. On the Somalian plateau, east of the rift, a denuded caldera has been identified as the source of much of the lavas of the Batu Mountains. Further south, ERTS-1 imagery amplifies the structural and lithological mapping of the Precambrian rocks of the Shakisso-Arero area, and of the Kenya-Ethiopia border region. For the first time with some certainty, it is now possible to say that on the evidence of the ERTS-1 imagery, the Western Rift does not continue northeast beyond the Sudan-Uganda border, and is thus not to be sought in western Ethiopia.

N74-11154*# Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
APPLICATION OF REMOTE SENSING IN THE STUDY OF VEGETATION AND SOILS IN IDAHO
E. W. Tisdale, Principal Investigator 5 Nov. 1973 1 p ref ERTS
(Contract NAS5-21850)
(E74-10016; NASA-CR-135857) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N74-11155*# Iowa State Univ. of Science and Technology, Ames. Iowa Agriculture Experimental Station.
REMOTE SENSING IN IOWA AGRICULTURE Progress Report, period ending 31 Oct. 1973
John P. Mahlstede, Principal Investigator and R. E. Carlson 9 Nov. 1973 3 p ERTS
(Contract NAS5-21839)
(E74-10020; NASA-CR-135861) Avail: NTIS HC $3.00 CSCL 02B

The author has identified the following significant results. Results include the estimation of forested and crop vegetation acreages using the ERTS-1 imagery. The methods used to achieve these estimates still require refinement, but the results appear promising. Practical applications would be directed toward achieving current land use inventories of these natural resources. This data is presently collected by sampling type surveys. If ERTS-1 can observe this and area estimates can be determined accurately, then a step forward has been achieved. Cost benefit relationship will have to be favorable. Problems still exist in these estimation techniques due to the diversity of the scene observed in the ERTS-1 imagery covering other part of Iowa. This is due to influence of topography and soils upon the adaptability of the vegetation to specific areas of the state. The state mosaic produced from ERTS-1 imagery shows these patterns very well. Research directed to acreage estimates is continuing.

N74-11156*# Old Dominion Univ. Research Foundation, Norfolk, Va.
TO RELATE CHLOROPHYLL AND SUSPENDED SEDIMENT CONTENT IN THE LOWER CHESAPEAKE BAY TO ERTS-1

IMAGERY Semiannual Report, 1 Feb. - 31 Jul. 1973
Peter Fleischer, Principal Investigator 14 Nov. 1973 11 p refs ERTS
(Contract NAS5-21816)
(E74-10021; NASA-CR-135862) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N74-11157*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Bimonthly Progress Report, Sep. - Oct. 1973
John E. Taber, Principal Investigator and S. S. Rifman Oct. 1973 4 p ERTS
(Contract NAS5-21814)
(E74-10022; NASA-CR-135863) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-11158*# Oceanographic Services, Inc., Santa Barbara, Calif.
ACQUISITION AND ANALYSIS OF COASTAL GROUND-TRUTH DATA FOR CORRELATION WITH ERTS-1 IMAGERY Progress Report, 2 Aug. - 2 Nov. 1973
William A. Anikouchine, Principal Investigator 12 Nov. 1973 5 p ERTS
(Contract NAS5-21877)
(E74-10023; NASA-CR-135864; PR-5) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. Radiance profiles drawn along cruise tracks have been examined for use in correlating digital radiance levels with ground truth data. Preliminary examination results are encouraging. Adding weighted levels from the 4 MSS bands appears to enhance specular surface reflections while rendering sensor noise white. Comparing each band signature to the added specular signature ought to enhance non-specular effects caused by ocean turbidity. Preliminary examination of radiance profiles and ground truth turbidity measurements revealed substantial correlation.

N74-11159*# State of Ohio Dept. of Development, Columbus.
RELEVANCE OF ERTS TO THE STATE OF OHIO Progress Report, Sep. - Oct. 1973
David C. Sweet, Principal Investigator Oct. 1973 8 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21782)
(E74-10024; NASA-CR-135865) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-11160*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENTS Interim Report, May - Nov. 1973
George A. Maul, Principal Investigator Nov. 1973 10 p ERTS
(NASA Order S-70246-AG)
(E74-10025; NASA-CR-135866) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. Fourteen field experiments in support of the NOAA investigation of ocean color boundary determination using ERTS-1 data have been conducted since June 1972. The boundary between coastal waters and the Loop Current has been detected by ERTS-1 as a result of sea state changes as well as color differences. Computer enchancement of MSS data are revealing many features not shown in the NDPF product. Analysis of the 24 channel MSS data shows that a thermal IR channel is required on an ERTS MSS to distinguish between atmospheric and sea state effects. Cloud cover analysis suggests the need for daily coverage of this type sensor for routinely useful oceanographic applications.

N74-11161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THIRD ERTS SYMPOSIUM: ABSTRACTS
Stanley C. Freden, Chairman and John H. Boeckel, Symp. Coordinator 14 Dec. 1973 133 p refs Symp. held at Washington, D. C., 10-14 Dec. 1973 ERTS
(E74-10027; NASA-TM-X-69450) Avail: NTIS HC $8.75 CSCL 05B

Abstracts are provided for the 112 papers presented at the Earth Resources Program Symposium held at Washington, D.C., 10-14 December, 1973. A.L.

N74-11162*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
ANALOG TO DIGITAL CONVERSION AND PROCESSING OF MSS DATA USING A HYBRID COMPUTER Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and C. E. Rambert May 1973 5 p ERTS
(Contract NAS5-23133)
(E74-10033; NASA-CR-135874; ORSER-SSEL-TR-24-73) Avail: NTIS HC $3.00 CSCL 09B

There are no author-identified significant results in this report.

N74-11163*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Oct. 1973
Paul M. Merifield, Principal Investigator 5 Nov. 1973 2 p EREP
(Contract NAS2-7698)
(E74-10042; NASA-CR-135883; MPR-5) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-11164*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Sep. 1973
Allan Shapiro, Principal Investigator 26 Oct. 1973 1 p EREP
(NASA Order T-4716-B)
(E74-10043; NASA-CR-135884) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-11165*# Agricultural Research Service, Weslaco, Tex.
REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Aug. - 19 Oct. 1973
Craig L. Wiegand, Principal Investigator 5 Nov. 1973 7 p ERTS
(NASA Order S-70251-AG)
(E74-10044; NASA-CR-135885; PR-5) Avail: NTIS HC $3.00 CSCL 20F

The author has identified the following significant results. A study was conducted in a 340-acre (139 hectares) field of grain sorghum (Sorghum bicolor (L.) Moench) to determine if multispectral data from ERTS-1 could be used to detect differences in chlorophyll concentration between iron-deficient (chlorotic) and apparently normal (green) grain sorghum. Chlorotic sorghum areas 2.8 acres (1.1 hectares) or larger in size were identified on a computer printout of band 5 data which contains the chlorophyll absorption band at the 0.65 micron wavelength. ERTS resolution is sufficient for practical applications in detecting iron-deficient sorghum in otherwise uniform fields. The first classification map of the study county has been produced. Vegetation (crops), rangeland, bare soil, water, and an undefined (all other) category occupied 15.2, 45.0, 19.1, 0.02, and 20.6% of the land area, respectively.

N74-11166*# Alaska Univ., Fairbanks.
EVALUATION OF FEASIBILITY OF MAPPING SEISMICALLY ACTIVE FAULTS IN ALASKA Bimonthly Progress Report
Larry Gedney, Principal Investigator 8 Oct. 1973 2 p refs ERTS
(Contract NAS5-21833)
(E74-10045; NASA-CR-135886; BMPR-7) Avail: NTIS HC

$3.00 CSCL 08C
There are no author-identified significant results in this report.

N74-11167*# Delaware Univ., Newark. Coll. of Marine Studies.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS
Karl-Heinz Szekielda, Principal Investigator Aug. 1973 12 p EREP
(Contract NAS9-13344)
(E74-10046; NASA-CR-135887) Avail: NTIS HC $3.00 CSCL 08A
There are no author-identified significant results in this report.

N74-11168*# Geological Survey, Washington, D.C. Geographic Applications Program.
URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report, Sep. 1973
Robert H. Alexander, Principal Investigator, John. Lewis, and James R. Wray 20 Oct. 1973 4 p EREP
(NASA Order T-5290-B)
(E74-10047; NASA-CR-135888) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

N74-11169*# Geological Survey, Washington, D.C. Geographic Applications Program.
URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report
Robert H. Alexander, Principal Investigator and James R. Wray 16 Jul. 1973 4 p EREP
(NASA Order T-5290-B)
(E74-10048; NASA-CR-135889) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

N74-11170*# Geological Survey, Washington, D.C. Geographic Applications Program.
URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report.
Robert H. Alexander, Principal Investigator and John Lewis 23 Aug. 1973 8 p EREP
(NASA Order T-5290-B)
(E74-10049; NASA-CR-135890) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results is this report.

N74-11171*# Texas Univ., Austin. Dept. of Geological Sciences.
STREAM NETWORK ANALYSIS FROM ORBITAL AND SUBORBITAL IMAGERY, COLORADO RIVER BASIN, TEXAS Quarterly Progress Report, Aug. - Oct. 1973
Victor R. Baker, Principal Investigator 5 Nov. 1973 6 p EREP
(Contract NAS9-13312)
(E74-10050; NASA-CR-135891; QPR-2) Avail: NTIS HC $3.00 CSCL 08H
The author has identified the following significant results. Orbital SL-2 imagery (earth terrain camera S-190B), received September 5, 1973, was subjected to quantitative network analysis and compared to 7.5 minute topographic mapping (scale: 1/24,000) and U.S.D.A. conventional black and white aerial photography (scale: 1/22,200). Results can only be considered suggestive because detail on the SL-2 imagery was badly obscured by heavy cloud cover. The upper Bee Creek basin was chosen for analysis because it appeared in a relatively cloud-free portion of the orbital imagery. Drainage maps were drawn from the three sources digitized into a computer-compatible format, and analyzed by the WATER system computer program. Even at its small scale (1/172,000) and with bad haze the orbital photo showed much drainage detail. The contour-like character of the Glen Rose Formation's resistant limestone units allowed channel definition. The errors in pattern recognition can be attributed to local areas of dense vegetation and to other areas of very high albedo caused by surficial exposure of caliche. The latter effect caused particular difficulty in the determination of drainage divides.

N74-11172*# Swiss Inst. of Meteorology, Zurich.
METEOROLOGICAL INTERPRETATION OF CLOUDS OR CLOUD SYSTEMS APPEARING ON PICTURES OF THE ALPINE REGION RECEIVED FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS-1) Preliminary Report No. 1
Alexandre Piaget Nov. 1973 35 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10051; NASA-CR-135892; Rept-37) Avail: NTIS HC $3.75 CSCL 04B
The author has identified the following significant results. Three examples of cloud-interpretation from ERTS-1 pictures are presented. When the wind speed is large enough, the cumuli are found arranged in lines that are in average two kilometers apart from each other. These lines are grouped in lines made of small cumuli and in lines made up of well developed ones. These last lines are fused on the APT picture and appear as single lines. Fog-mapping for a given region is possible if the topography of the region is known. The stratified clouds lying over mountains or in valleys begin to dissolve above the middle of the valleys and not against the slopes. As water shows a weak albedo in the near infrared, wet surfaces will appear darker than their neighborhoods. This feature seems to be confirmed by the dark spot in the north of Bozen (Southern Tyrol) that can be seen on the ERTS-1 picture taken on 31 August 1972.

N74-11173*# Agricultural Research Service, Weslaco, Tex.
IRRIGATION SCHEDULING, FREEZE WARNING AND SOIL SALINITY DETECTING Monthly Progress Report, Sep. - Oct. 1973
Craig L. Wiegand, Principal Investigator 5 Nov. 1973 2 p EREP
(NASA Order T-4105-B)
(E74-10052; NASA-CR-135893; MPR-4) Avail: NTIS HC $3.00 CSCL 08M
There are no author-identified significant results in this report.

N74-11174*# Minnesota State Planning Agency, St. Paul.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Sep. - 31 Oct. 1973
Joseph E. Sizer, Principal Investigator 31 Oct. 1973 5 p ERTS
(Contract NAS5-21801)
(E74-10053; NASA-CR-135894) Avail: NTIS HC $3.00 CSCL 08B
There are no author-identified significant results in this report.

N74-11175*# Corps of Engineers, Waltham, Mass.
NEW ENGLAND RESERVOIR MANAGEMENT Quarterly Progress Report, 23 Jul. - 23 Oct. 1973
Saul Cooper and Duwayne Anderson, Principal Investigators (CRREL) 23 Oct. 1973 4 p EREP
(NASA Order T-4646-B)
(E74-10054; NASA-CR-135895; QPR-2) Avail: NTIS HC $3.00 CSCL 08H
There are no author-identified significant results in this report.

N74-11176*# Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Progress Report, 1 Mar. - 1 Sep. 1973
P. N. Slater, Principal Investigator, R. L. Antos, and R. A. Schowengerdt Oct. 1973 27 p refs ERTS
(Contract NAS5-21849)
(E74-10055; NASA-CR-135896; PR-6) Avail: NTIS HC $3.50 CSCL 14E

There are no author-identified significant results in this report.

N74-11177*# Kennecott Exploration, Inc., Salt Lake City, Utah. Exploration Services Dept.
RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY COPPER DEPOSITS ON ERTS-1 IMAGERY Progress Report, Sep. - Oct. 1973
John C. Wilson, Principal Investigator 6 Nov. 1973 2 p ERTS
(Contract NAS5-21769)
(E74-10056; NASA-CR-135897) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-11178*# Geological Survey, Denver, Colo.
REMOTE SENSING GEOPHYSICS FROM SKYLAB Status Report, Oct. 1973
Kenneth Watson, Principal Investigator 26 Oct. 1973 2 p EREP
(NASA Order T-6555-B)
(E74-10057; NASA-CR-135957) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-11179*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth ReSources (ORSER).
ERTS AND AIRCRAFT MULTISPECTRAL SCANNER DIGITAL DATA USERS MANUAL
George J. McMurtry, Gary W. Petersen, Principal Investigators, F. Y. Borden, D. N. Applegate, B. J. Turner, H. M. Lachowski, and J. R. Hoosty [1973] 1 p ERTS
(Contract NAS5-23133)
(E74-10058; NASA-CR-135958; ORSER-SSEL-TR-11-73) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-11180*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Progress Report, Oct. 1973
George A. Maul; Principal Investigator Oct. 1973 2 p EREP
(NASA Order T-4713-B)
(E74-10059; NASA-CR-135959; MPR-4) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N74-11181*# Michigan State Univ., East Lansing.
INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Oct. 1973
Lester V. Manderscheid, Principal Investigator Oct. 1973 2 p EREP
(Contract NAS9-13332)
(E74-10060; NASA-CR-135960) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-11182*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN (RESOURCE INVENTORY, LAND USE, AND POLLUTION) Annual Report, 1 Jun. 1972 - 30 May 1973
George J. McMurtry and Gary W. Petersen, Principal Investigators Oct. 1973 260 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-23133)
(E74-10061; NASA-CR-135961 ; ORSER-SSEL-TR-9-73) Avail: NTIS HC $15.00 CSCL 08H

The author has identified the following significant results. An interdisciplinary group at Penn State University is analyzing ERTS-1 data. The geographical area of interest is that of the Susquehanna River Basin in Pennsylvania. The objectives of the work have been to ascertain the usefulness of ERTS-1 data in the areas of natural resources and land use inventory, geology and hydrology, and environmental quality. Specific results include a study of land use in the Harrisburg area, discrimination between types of forest resources and vegetation, detection of previously unknown geologic faults and correlation of these with known mineral deposits and ground water, mapping of mine spoils in the anthracite region of eastern Pennsylvania, and mapping of strip mines and acid mine drainage in central Pennsylvania. Both photointerpretive techniques and automatic computer processing methods have been developed and used, separately and in a combined approach.

N74-11183*# Vermont Univ., Burlington. Remote Sensing Lab.
APPLICATION OF ERTS-1 IMAGERY IN THE VERMONT-NEW YORK DISPUTE OVER POLLUTION OF LAKE CHAMPLAIN
A. O. Lind, Principal Investigator Oct. 1973 5 p refs ERTS
(Contract NAS5-21753)
(E74-10062; NASA-CR-135962) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. ERTS-1 imagery and a composite map derived from ERTS-1 imagery were presented as evidence in a U.S. Supreme Court case involving the pollution of an interstate water body (Lake Champlain). A pollution problem generated by a large paper mill forms the basis of the suit (Vermont vs. International Paper Co. and State of New York) and ERTS-1 imagery shows the effluent pattern on the lake surface as extending into Vermont during three different times.

N74-11184*# Old Dominion Univ. Research Foundation, Norfolk, Va. Inst. of Oceanography.
INVESTIGATION TO RELATE THE CHLOROPHYLL AND SUSPENDED SEDIMENT CONTENT IN THE WATERS OF THE LOWER CHESAPEAKE BAY TO ERTS-1 IMAGERY Bimonthly Report, 1 Aug. - 31 Sep. 1973
Peter Fleischer, Principal Investigator, John C. Ludwick, Hanna, Thomas Gosink, and David Bowker 31 Sep. 1973 2 p refs ERTS
(Contract NAS5-21816)
(E74-10067; NASA-CR-135822) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N74-11185*# Dartmouth Coll., Hanover, N.H. Dept. of Earth Sciences.
VOLCANIC ACTIVITY AND SATELLITE-DETECTED THERMAL ANOMALIES AT CENTRAL AMERICAN VOLCANOES Progress Report, Aug. - Oct. 1973
Richard E. Stoiber, Principal Investigator and William I. Rose, Jr. (Michigan Technological Univ.) Oct. 1973 5 p EREP
(Contract NAS9-13311)
(E74-10068; NASA-CR-135821) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A large nuee ardente eruption occurred at Santiaguito volcano, within the test area on 16 September 1973. Through a system of local observers, the eruption has been described, reported to the international scientific community, extent of affected area mapped, and the new ash sampled. A more extensive report on this event will be prepared. The eruption is an excellent example of the kind of volcanic situation in which satellite thermal imagery might be useful. The Santiaguito dome is a complex mass with a whole series of historically active vents. It's location makes access difficult, yet its activity is of great concern to large agricultrual populations who live downslope. Santiaguito has produced a number of large eruptions with little apparent warning. In the earlier ground survey large thermal anomalies were identified at Santiaguito. There is no way of knowing whether satellite monitoring could have detected changes in thermal anomaly patterns related to this recent event, but the position of thermal anomalies on Santiaguito and any changes in their character would be relevant information.

N74-11186*# Delaware Univ., Newark. Coll. of Marine Studies.
MAPPING COASTAL VEGETATION, LAND USE AND ENVIRONMENTAL IMPACT FROM ERTS-1 Report on Significant Results
V. Klemas, Principal Investigator 7 Nov. 1973 3 p refs ERTS
(Contract NAS5-21837)
(E74-10069; NASA-CR-135820) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Vegetation map overlays at a scale of 1:24,000 compiled by multispectral analysis from NASA aircraft imagery for all of Delaware's wetlands are being used as ground truth for ERTS-1 mapping and by state agencies for wetlands management. Six major vegetation species were discriminated and mapped, including percentages of minor species. Analogue enhancements of wetlands vegetation and dredge-fill operations have been produced using General Electric's GEMS data processing and ERTS-1 false color composites. Digital, thematic land use, and vegetation mapping of entire Delaware Bay area is in progress using Bendix Corporation's Earth Resources Data System and ERTS-1 digital tapes. Statistical evaluation of target-group selection reliability has been completed. Three papers have been published on ERTS-1 coastal vegetation and land use. Local and state officials are participating in the ERTS-1 program as co-investigators.

N74-11187*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
APPLICATIONS OF ERTS IMAGERY TO INVESTIGATING LAND USE AND NATURAL RESOURCES Progress Report, 14 Aug. - 13 Oct. 1973
Ernest E. Hardy, Principal Investigator 13 Oct. 1973 11 p ERTS
(Contract NAS5-21886)
(E74-10072; NASA-CR-135817) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-11188*# Geological Survey, Washington, D.C.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 15 Jan. - 31 Aug. 1973
Richard S. Williams, Jr., Principal Investigator 1 Sep. 1973 28 p refs ERTS
(NASA Order S-70243-AG)
(E74-10073; NASA-CR-135816) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Under a binational, multidisciplinary experiment ERTS-1 imagery is being used to measure and map dynamic natural phenomena in Iceland. A few of the initial results from the project are: (1) a large variety of geological and volcanic features can be studied, particularly on imagery acquired at low sun angle (< 10 deg), which have not been previously recognized; (2) under optimum snow cover conditions, geothermal areas can be discerned by their snowmelt pattern or by warm spring discharge into frozen lakes; (3) a variety of map types at scale of 1:1,000,000 and 1:500,000, can be compiled, made more accurate, or updated (changes in coastline, glaciers, lakes, etc.); (4) the persistence of snow in the highland areas, during the summer months, has important ramifications to rangeland management; (5) false color composites (MSS) permitted the mapping of four types of vegetation; forested, reclaimed, cultivated areas and grasslands, and the mapping of the seasonal change of the vegetation, all of high value to rangeland management when complete, repetitive coverage of Iceland becomes a reality with an operational satellite; and (6) the volcanic eruption on Heimaey was recorded.

N74-11189*# Geological Survey, Denver, Colo.
APPLICATION OF ERTS-1 IMAGERY TO DETECTING AND MAPPING MODERN EROSION FEATURES, AND TO MONITORING EROSIONAL CHANGES, IN SOUTHERN ARIZONA Progress Report, 1 Feb. - 31 Jul. 1973
Roger B. Morrison, Principal Investigator and Maurice E. Cooley 1 Aug. 1973 11 p refs ERTS
(NASA Order S-70243-AG-A)
(E74-10074; NASA-CR-135815) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. ERTS-1 multispectral images have been used, without additional data, to prepare three maps at 1:1 million scale of the 18,000 sq. mi. project area: (1) modern (post-1890 A. D.) arroyos and channels; (2) types of stream channels; and (3) potential erodibility of soils; surficial deposits, and bedrock. Also completed was the collection and compilation of ground truth geologic, soil, and hydrologic data. Field studies to obtain ground control for the photointerpretive mapping include: (1) measurements, at many sites, of the depth, width, and channel characteristics of arroyos and gullies, and cross profiles of stream channels, flood plains, and Holocene terraces; and (2) stratigraphic measurements of the Holocene alluvial deposits. Significant conclusions from these extensive stratigraphic studies are: Slow deposition of sediment was the dominant process on stream lowlands throughout the project area for at least 2000 years prior to 1890 A.D. The deposition was broken by only two relatively brief and minor erosional episodes of regional importance, when channels no more than a third of the depth of modern channels were cut. The modern erosion has produced within about 80 years substantially more and larger arroyos than any erosion episode during the last 2000 years, and the end is not in sight.

N74-11190*# Geological Survey, Washington, D.C.
EVALUATION OF ERTS-1 DATA APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Progress Report, 15 Jan. - 31 Aug. 1973
William D. Carter, Principal Investigator 1 Sep. 1973 28 p refs ERTS
(NASA Order S-70243-AG)
(E74-10075; NASA-CR-135814) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. ERTS-1 data is ideally suited for small-scale geologic mapping and structural analysis of remote, inaccessible areas such as the Andes of South America. The synoptic view of large areas, low sun-angle and multispectral nature of the images provide the right ingredients for improving existing geologic and other maps of the regions. In most areas it has been possible to compile geologic, drainage, and cultural interpretive overlays to individual scenes mainly using MSS bands 4, 5, and 7. A test image mosaic using MSS band 6 is being compiled for Test Area 7 (La Paz, Bolivia). It will be at a scale of 1:1,000,000 and cover 4 x 6 degrees of latitude and longitude and will serve as a compilation base on which to join the overlays. Repetitive data shows changes in river channels and sedimentation plumes, changes in lake shorelines, and surface moisture distribution. Vegetation and snow line changes in the Andes have been recognized. A year of seasonal data, however, has not yet been acquired due to tape recorder failure.

N74-11191*# Kansas Univ. Center for Research, Inc., Lawrence. Atmospheric Science Lab.
DETECTION OF MOISTURE AND MOISTURE RELATED PHENOMENA FROM SKYLAB Monthly Progress Report, Oct. 1973
Joe R. Eagleman, Ernest C. Pogge, Richard K. Moore, Principal Investigators, Norman Hardy, Wen Lin, and Larry League Oct. 1973 44 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13273)
(E74-10077; NASA-CR-135812) Avail: NTIS HC $4.25 CSCL 08H

The author has identified the following significant results. This is a preliminary report on the ability to detect soil moisture variation from the two different sensors on board Skylab. Initial investigations of S190A and SI94 Skylab data and ground truth has indicated the following significant results. (1) There was a decrease in SI94 antenna temperature from NW to SE across the Texas test site. (2) Soil moisture increases were measured from NW to SE across the test site. (3) There was a general increase in precipitation distribution and radar echoes from NW

to SE across the site for the few days prior to measurements. This was consistent with the soil moisture measurements and gives more complete coverage of the site. (4) There are distinct variations in soil textures over the test site. This affects the moisture holding capacity of soils and must be considered. (5) Strong correlation coefficients were obtained between S194 antenna temperature and soil moisutre content. As the antenna temperature decreases soil moisture increases. (6) The SI94 antenna temperature correlated best with soil mositure content in the upper two inches of the soil. A correlation coefficient of .988 was obtained. (7) SI90A photographs in the red-infrared region were shown to be useful for identification of Abilene clay loam and for determining the distribution of this soil type.

N74-11192*# Earth Satellite Corp., Washington, D.C. Geosciences and Environmental Applications Div.
FACILITATING THE EXPLOITATION OF ERTS-1 IMAGERY USING SNOW ENHANCEMENT TECHNIQUES Progress Report, 1 May - 1 Oct. 1973
Frank J. Wobber, Principal Investigator, Kenneth R. Martin, Roger V. Amato, and Thomas Leshendok Nov. 1973 63 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21744)
(E74-10080; NASA-CR-135969; ESC-141) Avail: NTIS HC $5.25 CSCL 14E

The author has identified the following significant results. The applications of ERTS-1 imagery for geological fracture mapping regardless of season has been repeatedly confirmed. The enhancement provided by a differential cover of snow increases the number and length of fracture-lineaments which can be detected with ERTS-1 data and accelerates the fracture mapping process for a variety of practical applications. The geological mapping benefits of the program will be realized in geographic areas where data are most needed - complex glaciated terrain and areas of deep residual soils. ERTS-1 derived fracture-lineament maps which provide detail well in excess of existing geological maps are not available in the Massachusetts-Connecticut area. The large quantity of new data provided by ERTS-1 may accelerate and improve field mapping now in progress in the area. Numerous other user groups have requested data on the techniques. This represents a major change in operating philosophy for groups who to data judged that snow obscured geological detail.

N74-11193*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT-LIVED EVENTS USING ERTS DATA Progress Report, 1 Sep. - 31 Oct. 1973
William A. Deutschman, Principal Investigator 31 Oct. 1973 1 p ERTS
(Contract NAS5-21858)
(E74-10081; NASA-CR-135970) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Forest fires, oil spills, vegetation damage, volcanoes, storm ridges, earthquakes, and floods have been detected and analyzed.

N74-11194*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report
Ernest E. Hardy, Principal Investigator 31 Oct. 1973 2 p EREP
(Contract NAS9-13364)
(E74-10082; NASA-CR-135971) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-11195*# Indiana Geological Survey, Bloomington.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Sep. - 1 Nov. 1973
Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas Leshendok 9 Nov. 1973 9 p Prepared in cooperation with Earth Satellite Corp., Washington, D. C. ERTS
(Contract NAS5-21795)
(E74-10083; NASA-CR-135972) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. The Mined Land Inventory map of Pike, Gibson, and Warrick Counties, Indiana, prepared from ERTS-1 imagery, was included in the 1973 Annual Report of the President's Council on Environmental Quality as an example of ERTS applications to mined lands. Increasing numbers of inquiries have been received from coal producing states and coal companies interested in the Indiana Program.

N74-11196*# Servicio Geologico de Bolivia, La Paz.
APPLICATION AND EVALUATION OF ERTS COLOR COMPOSITES FOR NATURAL RESOURCES INVENTORY [APLICACION Y EVALUACION DE IMGENES ERTS DE COMPOSITION DE COLOR AL INVENTARIO DE RECURSOS NATURALES]
Carlos Brockmann, Principal Investigator and Alvaro C. Fernandez [1973] 55 p refs In SPANISH; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10085; NASA-CR-135974) Avail: NTIS HC $4.75 CSCL 05B

The author has identified the following significant results. Bolivia is participating the Earth Resources Technology Satellite Program. Within this program many interesting sets of images were received which were evaluated in the Bolivian ERTS Program. One of the images was obtained in color of the central part of the Bolivian Altiplano. The color composite and black and white images were compared in order to evaluate which class of ERTS-1 product furnishes more information about specific topics. It was found that the color composites give far more information, about 50% more data, in hydrology, geomorphology, vulcanism, geology, soils, and vegetation than can be obtained from black and white images of the same scene. For this reason, the project is processing with preference color composites of the whole country.

N74-11197*# Battelle Columbus Labs., Ohio.
GEODETIC ANALYSIS OF SKYLAB ALTIMETRY PRELIMINARY DATA - SL/2 EREP PASS 9
A. G. Mourad, Principal Investigator and D. M. J. Fubara 21 Nov. 1973 28 p refs Presented at the Fall Ann. Meeting of the Am. Geophys. Union, San Francisco, 11 Dec. 1973 EREP
(Contract NAS9-13276)
(E74-10086; NASA-CR-135975) Avail: NTIS HC $3.50 CSCL 08E

The author has identified the following significant results. The analysis was based on a time series intrinsic relationship between the satellite ephemeris, altimeter measured ranges, and the corresponding a priori values of subsatellite geoidal heights. Using sequential least squares processing with parameter weighting, the objective was to recover (1) the absolute geoidal heights of the subsatellite points, and (2) the associated altimeter calibration constant(s). Preliminary results from Skylab altimetry are given, using various combinations of orbit ephemeris and altimeter ranges as computed differently by NASA/JSC and NASA/Wallops. The influences of orbit accuracy, weighting functions, and a priori ground truth are described, based on the various combination solutions. It is shown that to deduce geoidal height by merely subtracting the height of the satellite from the altimeter range is inadmissible. The results of such direct subtraction can be very misleading if the orbit used is computed from data that included altimeter data used as height constraints. In view of the current state of knowledge, the use of geodetic ground truth samples as control benchmarks appears indispensable for the recovery of absolute geoidal heights with correct scale.

N74-11198*# Naval Research Lab., Washington, D.C.
[ADAPTATION OF COMPUTER PROGRAMMING TO OUTPUT FORM OF ALTIMETER DATA] Monthly Progress Report, 1 Jul. - 1 Aug. 1973
A. Shapiro, Principal Investigator 24 Aug. 1973 1 p EREP

(NASA Order T-4716-B)
(E74-10087; NASA-CR-135976; MR-1) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-11199*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN HYDROLOGICAL USES Progress Report, Aug. - Sep. 1973
Donald R. Wiesnet and David F. McGinnis, Principal Investigators Sep. 1973 4 p ERTS
(NASA Order S-70246-AG)
(E74-10088; NASA-CR-136000) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. A snow-extent map of the American River basin was prepared for 27 May 1973 from MSS band 4 imagery. The basin was 14% snow covered. NOAA-2 visible band imagery was used to determine date of disappearance of snow in the basin: 15 July 1973. A snowmelt curve comparing ERTS-1 and NOAA-2 snow-extent maps is provided. ERTS-1 data were superior in quality and outstanding in cartographic fidelity and were found to be an excellent control or calibration for the distorted and coarse (1 km) imagery from NOAA-2's VHRR which, however, is available on a daily basis.

N74-11200*# Arizona Univ., Tucson. Dept. of Biological Sciences.
DETERMINATION OF SPECIES Progress Report
C. H. Lowe, Principal Investigator and D. Slaymaker 7 Nov. 1973 1 p ERTS
(Contract NAS5-21819)
(E74-10089; NASA-CR-136001; PR-5) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-11201*# Bureau de Recherches Geologiques et Minieres, Orleans (France). Dept. Carte Geologique et Geologie Generale.
GEOLOGICAL STUDY IN THE SOUTHERN PART OF MADAGASCAR Progress Report, Jun. - Oct. 1973
G. Weecksteen, Principal Investigator and B. Koch Oct. 1973 17 p refs Sponsored by NASA ERTS
(E74-10090; NASA-CR-136002) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-11202*# Research Triangle Inst., Research Triangle Park, N.C.
[RADAR BACKSCATTERING AS A MEANS FOR MEASURING OCEAN SURFACE PARAMETERS USING S193 ALTIMETRY AND S190B PHOTOGRAPHY] Monthly Progress Report, 1-31 Oct. 1973
Charles L. Britt, Jr., Principal Investigator 26 Nov. 1973 1 p EREP
(Contract NAS9-13304)
(E74-10092; NASA-CR-136004) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N74-11203# Illinois Univ., Urbana. Aeronomy Lab.
INVESTIGATION OF INCOHERENT-SCATTER SPECTRAL ASYMMETRIES IN THE TOPSIDE F REGION
I. D. Countryman and S. A. Bowhill 1 Oct. 1973 66 p refs
(Grant NSF GA-27295)
(UILU-Eng-73-2507; AERONOMY-57) Avail: NTIS HC $5.50

Incoherent-scatter data taken over Millstone Hill, Mass. for an altitude of 450 km are analyzed for power spectrum asymmetries. Since asymmetries are found that cannot be attributed to sampling or system error, these asymmetries were interpreted in terms of electron streaming. The average of thermal electron fluxes measured are 38 x 10 to the 8th power/sq cm/sec downward in the morning and 27 x 10 to the 8th power/sq cm/sec downward in the afternoon. The nighttime average is assumed zero. The source of these postulated thermal electron fluxes is concluded to be coulombic equalization of the entire spectrum of photoelectron flux. Author

N74-11204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRBORNE PROFILING OF ICE THICKNESS USING A SHORT PULSE RADAR
R. S. Vickers (Colo. State Univ.), J. Heighway, and R. Gedney 1973 7 p refs Presented at Advanced Concepts and Techniques in the Study of Snow and Ice Resources, Monterey, Calif., 2-6 Dec. 1973
(NASA-TM-X-71481) Avail: NTIS HC $3.00 CSCL 08L

The acquisition and interpretation of ice thickness data from a mobile platform has for some time been a goal of the remote sensing community. Such data, once obtainable, is of value in monitoring the changes in ice thickness over large areas, and in mapping the potential hazards to traffic in shipping lanes. Measurements made from a helicopter-borne ice thickness profiler of ice in Lake Superior, Lake St. Clair and the St. Clair river as part of NASA's program to develop an ice information system are described. The profiler described is a high resolution, non-imaging, short pulse radar, operating at a carrier frequency of 2.7 GHz. The system can resolve reflective surfaces separated by as little as 10 cm. and permits measurement of the distance between resolvable surfaces with an accuracy of about 1 cm. Data samples are given for measurements both in a static (helicopter hovering), and a traverse mode. Ground truth measurements taken by an ice auger team traveling with the helicopter are compared with the remotely sensed data and the accuracy of the profiler is discussed based on these measurements. Author

N74-11205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF THERMAL IMAGERY TO THE DEVELOPMENT OF A GREAT LAKES ICE INFORMATION SYSTEM
R. J. Schertler, C. A. Raquet, and R. A. Svehla 1973 11 p refs Presented at the Interdisciplinary Symp. on Advanced Concepts and Tech. in the Study of Snow and Ice Resources, Monterey, Calif., 2-6 Dec. 1973
(NASA-TM-X-71478) Avail: NTIS HC $3.00 CSCL 08L

Recent measurements and analysis have shown that thermal infrared imagery (wavelength, 8-14 microns) can be employed to delineate the relative thicknesses of various regions of freshwater ice, as well as, differentiate new ice from both open water areas and thicker (young)ice. Thermal imagery was observed to be generally superior to visual (0.4 - 0.7 microns) and our SLAR (3.3 cm) imagery for estimating relative ice thicknesses and delineating open water from new ice growth. In a real-time Great Lakes Ice Information System, thermal imagery can not only provide supplementary imagery but also aid in developing interpretative methods for all-weather SLAR imagery, as well as, establishing the areal extent of spot thickness measurements. Author

N74-11206# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES OF LARGE SCALE ATMOSPHERIC ENERGETICS Final Report
L. H. Horn and D. R. Johnson Aug. 1972 77 p refs
(Grant NOAA-NESS-1-35229)
Avail: NTIS HC $6.00

The atmospheric energetics describe the large scale motions of the atmosphere with emphasis on the employment of meteorological satellite data. Various modes are given of the poleward energy transport in the North American region and to various large scale synoptic features of the transport. The role of infrared cooling in generating available potential energy at the storm scale is studied, employing the exact form of the generation equation and Nimbus 2 infrared observations. An application of the indirect sounding procedure is included. For individual titles, see N74-11207 through N74-11209.

N74-11207 Wisconsin Univ., Madison.
ATMOSPHERIC ENERGY TRANSPORT OVER NORTH AMERICA FOR THREE WINTER MONTHS
Elford G. Astling (Fla. State Univ.) and Lyle H. Horn *In its* Studies of Large Scale Atmospheric Energetics Aug. 1972

p 1-12 refs Repr. from Monthly Weather Rev., v. 100, no. 6, Jun. 1972 p 491-502 Sponsored in part by NSF (For availability see N74-11206 02-13)
(Grants NOAA-NESS-WBG-52; NOAA-NESS-E-8-69(G))

The North American radiosonde network is used to calculate the poleward energy transport for the continental area during the period January-March 1966. The transport of sensible and latent heat and geopotential and kinetic energy is partitioned according to four circulation modes--mean and transient meridional circulations and stationary and transient eddy circulations. In addition, the roles of various synoptic features in the transient eddy flux are examined. The mean meridional transport was computed in two ways. One involved a calculation of the contribution of the North American sector to the hemispheric mean meridional transport. Because of strong meridional flow at high levels and a lack of compensating flow at low levels, very large transports were obtained. Author

N74-11208 Wisconsin Univ., Madison.
THE GENERATION OF AVAILABLE POTENTIAL ENERGY BY INFRARED COOLING: A SUMMER CASE
T. A. MacKenzie and Lyle H. Horn *In its* Studies of Large Scale Atmospheric Energetics Aug. 1972 p 13-43 refs (For availability see N74-11206 02-13)

The exact form of the generation equation is used to estimate the generation of available potential energy by infrared radiational cooling during a summer case. Models of the vertical distribution of infrared cooling and Nimbus 2 radiation data were employed. The tendency for infrared cooling to aid in static destabilization is important in cyclone development. Author

N74-11209 Wisconsin Univ., Madison.
AN APPLICATION OF THE SATELLITE INDIRECT SOUNDING TECHNIQUE IN DESCRIBING THE HYPERBAROCLINIC ZONE OF A JET STREAK
William E. Togstad and Lyle H. Horn *In its* Studies of Large Scale Atmospheric Energetics Aug. 1972 p 44-70 refs (For availability see N74-11206 02-13)

Weather producing features such as the jet streak are not adequately resolved at the input stage of numerical models. The satellite indirect sounding technique offers promise of greatly increasing observational detail. A case study is used to test the ability of the SIRS algorithm to resolve the thermal support of a jet streak. Isentropic cross sections through the streak are prepared and 17 synthetic soundings are obtained. The sounding data are reduced to equivalent irradiances, and the SIRS algorithm is used to retrieve the thermal structure for various assumed observational errors, grid spacings, and initial guess profiles. While an observational error permits the reconstruction of the general wind field, accuracies to within 0.10 and preferably 0.05 ergs are required to resolve the essential structure of the jet streak's thermal support. Author

N74-11210*# Kanner (Leo) Associates, Redwood City, Calif.
POSSIBILITY OF SURVEYING ITALIAN EARTHQUAKES BY MEANS OF A NETWORK OF STRONG MOTION ACCELEROGRAPHS
E. Iaccarino Washington NASA Nov. 1973 40 p refs Transl. into ENGLISH of the publ. "Possibilita di Rilevare un Terremoto sul Territorio Italiano per Mezzo di una Rete di Accelerografi" Italy, CNEN, Safety and Control Div., 1971 p 1-29
(Contract NASw-2481)
(NASA-TT-F-15170) Avail: NTIS HC $4.00 CSCL 08K

After having examined the necessity of installing in Italy a network of strong motion accelerographs, a study was carried out to evaluate the probability of picking up by means of this network an event of intensity 6 or more. In addition, the number of accelerograms obtained each year was calculated. This study was performed by using the results of the statistical analysis of the areas surrounded by the isoseismals of 470 earthquakes experienced in Italy from 1893 to 1965. Moreover, for a regular mesh network, it was possible to examine how the results vary with the distance between two instruments located at the tie point of the mesh. At least, since these results are theoretical, it has been shown how to evaluate actual cases for a network of any shape. Author

N74-11211*# Scripta Publishing Corp., Washington, D.C.
GRAVITATIONAL WAVES: A MEANS OF COMMUNICATION WITH HIGHLY DEVELOPED CIVILIANS
V. B. Kudrin NASA Aug. 1973 3 p Transl. into ENGLISH from Kosm. Issled. (USSR) p 98-99
(Contract NASw-2484)
(NASA-TT-F-15060) Avail: NTIS HC $3.00 CSCL 20J

Ways to communicate with highly developed alien (extraterrestrial) civilizations are presented. The gravitation-wave method is cited as being the most suitable, due to the inadequacies of radio-wave communications. Author

N74-11212*# East Tennessee State Univ., Johnson City. Commission of Geographic Applications of Remote Sensing.
THE APPLICABILITY OF REMOTE SENSING TO THE DETECTION, IDENTIFICATION, AND MONITORING OF POWER TRANSMISSION RIGHT-OF-WAYS WITHIN SELECTED AREAS OF THE TVA REGION Final Report
John B. Rehder (Tenn. Univ.) May 1972 14 p Sponsored in part by NASA and TVA
(NASA-CR-135868; USGS-IR-247) Avail: NTIS HC $3.00 CSCL 08B

The feasibility of using high altitude imagery is discussed for the analysis of power transmission phenomena in the TVA region. The procedure and methodology are given for identifying small, low resolution phenomena; transmission lines and towers, large scale, high resolution phenomena; right- of-ways, and power production sites, and steam plant transmission lines. T.M.R

N74-11213*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
URBAN-FIELD LAND USE FROM RB-57 PHOTOGRAPHY: THE BOSTON AND NEW HAVEN AREAS Final Report
Robert B. Simpson, Robert S. Yuill, and David T. Lindgren 30 Jun. 1972 87 p refs
(NASA Order W-13318; Contract USGS-14-08-0001-12958)
(NASA-CR-136078; USGS-IR-252) Avail: NTIS HC $6.50 CSCL 08B

Comparison of information from aerial photography with concurrently derived U.S. Census information for the New Haven area is a follow-on to a prototype effort in the Boston area. Using computer techniques developed in the earlier study, a land use map was created supplemented by tabular printouts of statistical data per land use category. The combined experience suggests that interpretation of photography directly into machine readable form would be desirable and comparison of repetitive coverage would permit meaningful change detection of urban land use. Author

N74-11214*# IIT Research Inst., Chicago, Ill.
CORRELATION SIGNATURES OF WET SOILS AND SNOWS Final Report, 22 Mar. 1971 - 22 Sep. 1972
M. R. Phillips Oct. 1972 180 p
(Contract NAS8-26797)
(NASA-CR-124004; IITRI-J6243-6) Avail: NTIS HC $11.00 CSCL 08M

Interpretation, analysis, and development of algorithms have provided the necessary computational programming tools for soil data processing, data handling and analysis. Algorithms that have been developed thus far, are adequate and have been proven successful for several preliminary and fundamental applications such as software interfacing capabilities, probability distributions, grey level print plotting, contour plotting, isometric data displays, joint probability distributions, boundary mapping, channel registration and ground scene classification. A description of an Earth Resources Flight Data Processor, (ERFDP), which handles and processes earth resources data under a users control is provided. Author

N74-11215*# National Aeronautics and Space Administration, Washington, D.C.
SKANE FROM AN ALTITUDE OF 900 KILOMETERS
H. Svensson Nov. 1973 6 p Transl. into ENGLISH from Sv. Geografisk Aersbok (Sweden), v. 48, 1972 p 137-140
(NASA-TT-F-15201) Avail: NTIS HC $3.00 CSCL 05B

ERTS-1, an unmanned observation satellite at an altitude of 900 km, takes pictures of the earth's surface in several frequency bands and relays them to ground by telemetry. Coastal formations

are seen to be clearest in the visible spectral ranges, while ground cover is differentiated best in the IR channels. Author

N74-11216*# National Aeronautics and Space Administration, Washington, D.C.
THE FIRST ERTS-PICTURES OVER SKANE
H. Svensson Nov. 1973 13 p Transl. into ENGLISH from Geografiska Notiser (Sweden), v. 31, no. 1, 1973 p 19-23
(NASA-TT-F-15202) Avail: NTIS HC $3.00 CSCL 05B

Scientists from many countries are cooperating in the American ERTS program, which uses unmanned satellites to collect data for evaluating and managing the earth's resources. ERTS-1 has equipment for collecting data at several different wavelength ranges, for storing the data, and for transmitting it to ground. Accuracy and resolution are found to be exceptionally good and present unique possibilities for studying the earth's surface under differing weather conditions and seasons. Author

N74-11217*# National Aeronautics and Space Administration, Washington, D.C.
MULTI-SPECTRAL REPRODUCTION FROM ERTS-1
H. Svensson Nov. 1973 9 p Transl. into ENGLISH from Geografiska Notsier (Sweden), v. 31, no. 3, 1973 p 127-130
(NASA-TT-F-15203) Avail: NTIS HC $3.00 CSCL 14E

Although ERTS-1 has been in operation for one year, parts of southern Sweden have not yet been photographed because of technical problems and unfavorable weather conditions. Recording in several spectral ranges is shown to be of value for different geographical areas. ERTS pictures can be useful both for analysis of well investigated and relatively poorly investigated areas. Author

N74-11218*# National Aeronautics and Space Administration, Washington, D.C.
TERMINAL MORAINES OBSERVED IN ERTS-1 PICTURES
H. Svensson Nov. 1973 9 p refs Transl. into ENGLISH from Geol. Foren. Stockholm Forch. (Sweden), v. 95, 31 Mar. 1973 p 146-149
(NASA-TT-F-15204) Avail: NTIS HC $3.00 CSCL 08E

The ERTS-1 experiment is briefly presented. Based on ERTS images of the southwestern part of Sweden and the adjacent coast area of Norway the detection of terminal moraines from the deglaciation period of the last glaciation is discussed. The moraine line of the Ra-substage (Younger Dryas) is especially observable. Author

N74-11219# World Meteorological Organization, Geneva (Switzerland).
MEANS OF ACQUISITION AND COMMUNICATION OF OCEAN DATA. VOLUME 2: SURFACE, SUB-SURFACE AND UPPER-AIR OBSERVATIONS
1973 619 p refs Partly in ENGLISH, FRENCH, and SPANISH Proc. of the WMO Tech. Conf., Tokyo, 2-7 Oct. 1972
(WMO-350; MSA-7-Vol-2) Avail: NTIS HC $33.00; WMO, Geneva

The contributions to the WMO conference are presented in two themes: surface and sub-surface observations, and upper-air observations. The first section includes papers on ocean data acquisition systems; status of buoy development; and sea surface temperature measurement. The second section covers methods of making upper air observations, which are balloon and radiosonde techniques. For individual titles, see N74-11220 through N74-11266.

N74-11220 United Nations Educational, Scientific and Cultural Organization, Paris (France).
LEGAL PROBLEMS ASSOCIATED WITH UNMANNED OCEAN DATA ACQUISITION SYSTEMS (ODAS) c34
D. P. D. Scott *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 1-8 refs (For availability see N74-11219 02-13)

The types of ocean data acquisition systems (ODAS) are outlined and the legal problems relating to unmanned systems are discussed. International cooperation in the recovery and return, and registry of ODAS is encouraged. Other aspects covered are illegal acts, deployment, collision liabilities, salvage, markings, and signals. ESRO

N74-11221 New York Univ., N.Y. Dept. of Meteorology and Oceanography.
A PROOF OF CONCEPT TEST OF A METHOD FOR DETERMINING THE WIND AND PRESSURE FIELDS IN THE PLANETARY BOUNDARY LAYER AND MEASURING WAVE HEIGHT OVER THE OCEAN BY MEANS OF A COMBINATION RADAR-PASSIVE MICROWAVE-ALTIMETER ON SKYLAB
W. J. Pierson and R. K. Moore *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 9-46 refs (For availability see N74-11219 02-13)
(Contract NOAA-NG-31-72)

A combination scanning pencil beam radar-radiometer and altimeter, carried on Skylab, is described. The radar sea return and passive microwave measurements can be used to infer the winds and the wind stress over the oceans, and determine the vector wind and the atmospheric pressure field. The pulse shape in the altimeter mode contains information on wave height. This information can be used both to improve and verify numerical wave forecasting schemes. The aircraft program that developed these concepts is described. Theoretical work to develop the computer software to analyze the data from this instrument and integrate it into conventional data is described. This includes procedures for forecasting wave spectra, analyzing the wind fields in the planetary boundary layer, and simulations of procedures that integrate spacecraft data into the analysis of conventional data. Author (ESRO)

N74-11222 Environmental Protection Agency, Washington, D.C.
REMOTE SENSORS AND THEIR APPLICATION TO OCEANOGRAPHIC MONITORING
A. S. Lefohn and W. T. Sayers *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 48-55 refs (For availability see N74-11219 02-13)

Remote sensing techniques as monitoring tools are described along with several types of sensor. These include infrared thermal scanners, simple camera systems (infrared color film), multiband cameras, multichannel scanning radiometers and chlorophyll correlation radiometers. The advantages and the state-of-the-art usage of these sensors are briefly noted. ESRO

N74-11223 Puget Sound Univ., Tacoma, Wash.
NASA REMOTE SENSING OF SEA ICE IN AIDJEX
W. J. Campbell *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 56-66 refs (For availability see N74-11219 02-13)

AIDJEX (Arctic Ice Dynamics Joint Experiment) is described as an international and interdisciplinary study of the sea ice of the Arctic Ocean whose objective is to understand the dynamics and thermodynamic interaction between sea ice and its environment. A series of three AIDJEX pilot experiments using microwave radiometers aboard a CV-990 aircraft were made during the spring of 1970, 1971, and 1972, in the southern Beaufort Sea. The experiments and their results are described. ESRO

N74-11224 Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
SEA ICE RECONNAISSANCE WITH THE RADAR
T. Tabata *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 67-75 refs (For availability see N74-11219 02-13)

A radar network enabling the observation of sea ice distribution, and movement, along the Okhotsk Sea coast of Hokkaido, at any desired moment is described. ESRO

N74-11225 Meteorological Office (Gt. Brit.).
DEFICIENCIES IN SHIPBOARD OBSERVATIONS c20
M. E. Robson *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 76-81 refs (For availability see N74-11219 02-13)

Difficulties in obtaining representative and reliable measurements of air temperature and humidity, sea temperature, barometric pressure, and rainfall are discussed along with the difficulties of estimating cloud and wave heights, visibility and surface wind on board ships at sea. Suggestions are made for improving the accuracy of some of these measurements. Author (ESRO)

N74-11226 National Ocean Survey, Rockville, Md. Meteorology Div.
STANDARDS AND TECHNIQUES TO QUALIFY OCEANOGRAPHIC INSTRUMENT MEASUREMENTS c14
R. J. Farland *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 82-95 refs (For availability see N74-11219 02-13)

The present situation with regard to the performance of instruments for oceanographic purposes is reviewed. A standards program for measurement techniques is described. The standardization of calibration procedures is also discussed.
ESRO

N74-11227 Ministry of Defence, London (England). Meteorology and Oceanographic Services.
THE RECORDING OF SEA SURFACE TEMPERATURES IN SHIPS OF THE ROYAL NAVY
J. G. Rees *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 96-103 (For availability see N74-11219 02-13)

Equipment has been installed in ships of the Royal Navy which record continuously the near-surface sea temperature. The purpose of the equipment is discussed and some factors outlined which influenced the choice of sensing element, the design of the hull mounting which carries the sensor, and the choice of a suitable recorder. The siting of the sensor on the vessel is also discussed.
Author (ESRO)

N74-11228 Direction de la Meteorologie Nationale, Paris (France).
EVOLUTION OF METEOROLOGICAL OBSERVATION METHODS ONBOARD SHIPS [EVOLUTION DES MOYENS D'OBSERVATION METEOROLOGIQUE A BORD DES NAVIRES] c20
H. P. Treussart *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 104-115 refs In FRENCH (For availability see N74-11219 02-13)

The forseeable evolution of observation equipment which merchant ships, selected to expand the meteorological networks, use or will use is discussed. The automation of shipboard surface measurements is considered in terms of a series of steps: first, automation of the measurements; second, automation of transmission; and third, integral automation. Particular problems posed by the measurement of certain parameters are discussed. These include measurement of temperature, humidity, atmospheric pressure and waves. Finally a comparison is made of data obtained by shipboard observations and newer methods.
ESRO

N74-11229 Tokyo Univ. (Japan). Ocean Research Inst.
A SHIPBORNE WAVE-RECORDING SYSTEM WITH DIGITAL DATA PROCESSING c12
K. Taira, A. Takeda, and K. Ishikawa (Min. of Posts and Telecommun.) *In* WMO Means of Acquisition and Commun. of Ocean Data Vol. 2 1973 p 116-125 refs (For availability see N74-11219 02-13)

A shipboard wave recording system consisting of a sonic anemometer and a sonic wave gauge, mounted on the bow-boom of a research ship is described. The response characteristics of the gauge are described. Velocities and displacements of the gauge platform are required for the correction of wind speed and wave height errors caused by the ship's movement. Integration of the acceleration of the ship's movement is indispensable for shipboard observation and a numerical method of double-integration of the acceleration is described.
ESRO

N74-11230 Hokushin Electric Works Ltd., Tokyo (Japan).
MARINE DATA LOGGER FOR THE JAPANESE OCEANOGRAPHICAL SURVEY SHIP 'AKASHI' c14
S. Teramoto *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 126-133 (For availability see N74-11219 02-13)

A marine data logger installed in a Japanese oceanographic survey ship is described. The logger functions to recover the various electric signals produced by onboard measuring instruments. These instruments are used for the acquisition of oceanographic parameters as well as navigation and engine data. By means of a time signal synchronized to the ship's master clock, the input signals undergo analog to digital conversion and can then be printed out at regular intervals or on request.
ESRO

N74-11231 National Ocean Survey, Rockville, Md. Office of Marine Technology.
STATUS OF DATA BUOY DEVELOPMENT IN THE UNITED STATES
W. M. Nicholson *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 134-156 refs (For availability see N74-11219 02-13)

Progress made in the last two years on the development of buoys for data collection is reviewed and an assessment of the future is attempted. The oceanographic and meteorological parameters which should be measured and the degree of accuracy required are tabulated. Problems such as buoy drifting and servicing are mentioned and plans for buoy interrogation using Nimbus and GOES satellites and the Omega navigation system are discussed.
ESRO

N74-11232 Woods Hole Oceanographic Institution, Mass.
ANALYSIS OF TAUT BUOY-MOORING TECHNOLOGY
R. G. Walden and N. N. Panicker *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 157-169 refs (For availability see N74-11219 02-13)
(Contract N00014-66-C-0241; NR Proj. 083-004)

The Woods Hole Oceanographic Institution has been using deep-sea moored buoys for acquiring serial observations of ocean currents, temperature and other data for over twelve years. A brief description of the deep-sea mooring program is given. The mooring statistics and performance are described. Mooring failures of 1970 and 1971 have been categorized and statistics on the modes and causes of failures are presented. The reliabilities of different types of moorings are computed and compared. The role of radio telemetry for the real-time measurement of mooring line tension and its use in checking the mooring status are discussed.
Author (ESRO)

N74-11233 Massachusetts Inst. of Tech., Cambridge.
UNDERWAY AND SCANNING MEASUREMENT OF AIR-SEA SURFACE LAYER PROPERTIES c12
E. Mollo-Christensen and P. Koziol *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 170-185 refs (For availability see N74-11219 02-13)

The potential of towed sensors for the determination of space and time scales of sea surface layer microscale phenomena is explored. In order to compare the resolution power of such methods and that of a buoy array, the spectral resolution for horizontally homogeneous time stationary random phenomena is discussed together with methods for determining statistical measures of a field from scanning observations. The means for obtaining data by scans is described and examples and results are given.
ESRO

N74-11234 Meteorological Office (Gt. Brit.).
LOW-POWER HUMIDITY SENSOR FOR UNATTENDED USE ON BUOYS c14
C. K. Folland *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 186-198 refs (For availability see N74-11219 02-13)

The potential was investigated of the PCRC-11 sensor for the automatic measurement of humidity in remote areas. A five month comparison was made of data obtained, on land, with the sensor and with standard screen observations. Laboratory calibration using a precision humidity generator and an automatic dewpoint hygrometer are described.
ESRO

N74-11235 Meteorological Office (Gt. Brit.).
OFFSHORE TELEMETERING BUOY FOR REAL-TIME MONITORING OF SENSOR PERFORMANCE c14
M. J. Blackwell and K. J. T. Sands *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 199-201 (For availability see N74-11219 02-13)

The long-term program of development and evaluation leading ultimately to the emergence of an economic medium-capability buoy for operational service in the North Sea and North Atlantic is discussed. The measurements (temperature, humidity, wind, pressure) to be made by the sensors are outlined and the sea

trails during 1972 are discussed. The telemetry link to provide real-time monitoring of the results is described. ESRO

N74-11236 Centre National pour l'Exploitation des Oceans, Paris (France).
FRENCH EXPERIMENTS WITH BUOYS [EXPERIENCES FRANCAISES DE BOUEES]
M. Vitureau *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 202-207 In FRENCH (For availability see N74-11219 02-13)

The French experience gained by theoretical and experimental results with buoys is discussed. The buoys themselves and the location are described. Cooperation with the Eole satellite program, in which the satellites that normally interrogate balloons will also interrogate the buoys, is discussed. Conclusions derived from the various experiments are drawn. ESRO

N74-11237 World Meteorological Organization, Geneva (Switzerland).
AN AUTOMATIC LIGHT BUOY [UNE BOUEE AUTOMATIQUE LEGERE]
M. Martinais and M. Turriere *In its* Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 208-215 In FRENCH (For availability see N74-11219 02-13)

The experiments and results obtained with light buoys in various locations are described. The general conception of the buoy is discussed, as well as the sensors, mooring, and radio telemetry links. The use of the buoy for acquisition of oceanographic and meteorological data is discussed. ESRO

N74-11238 Norwegian Meteorological Inst., Blindern.
THE NORWEGIAN METEOROLOGICAL MET-BUOY **c20**
C. K. Jensen *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 216-223 (For availability see N74-11219 02-13)

The Norwegian meteorological buoy project is described which covers experiments with drifting and anchored buoys in the Norwegian Sea. The buoy platform is described and details of the sensors (wind speed and direction, temperature, air pressure) are given. Other aspects of the system such as the power supply, transmitter, interrogation method and position locator are also discussed. ESRO

N74-11239 Japan Meteorological Agency, Tokyo. Meteorological Research Inst.
MARINE METEOROLOGICAL BUOYS OF THE JAPAN METEOROLOGICAL AGENCY **c20**
Y. Kawano *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 244-229 (For availability see N74-11219 02-13)

The experience gained by deployment and operation of meteorological buoys in the Japan Sea is discussed, together with the important engineering and environmental data obtained. The specifications and performance of the buoys are tabulated and the types of sensors outlined. ESRO

N74-11240* Washington Univ., Seattle. Lab. of Applied Physics.
THE ARCTIC DATA BUOY. A SYSTEM FOR ENVIRONMENTAL MONITORING IN THE ARCTIC
D. P. Haugen and E. G. Kerut (Natl. Data Buoy Center) *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 230-241 refs Sponsored jointly by Naval Oceanog. Office, NSF, and Naval Arctic Res. Lab. (For availability see N74-11219 02-13)
(Contract NAS8-26886)

An automated data buoy system for environmental monitoring in the Arctic was developed. The buoy is designed to operate for a minimum of 1 year providing position and environmental data through polar-orbiting satellite telecommunications. It can be deployed by a two or three man crew using a small aircraft. It is capable of operating in both free-floating and frozen-in situations. An experimental unit successfully completed a 5-month test at Fletcher's Ice Island (T-3) during the winter of 1971-72 and six units were deployed in the Arctic during the spring of 1972. Results to data have demonstrated the utility of the basic design, the effectiveness of the satellite communications, and the feasibility of deploying and operating a large array of such buoy systems in the Arctic Ocean. Author (ESRO)

N74-11241 Washington Univ., Seattle.
ARCTIC DATA BUOYS AND AIDJEX
P. Martin *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 242-249 refs (For availability see N74-11219 02-13)

The effect of the Arctic Ocean on the earth's weather system is discussed. In an attempt to learn more of the ice environment, the Arctic Ice Dynamics Joint Experiment (AIDJEX) was set up, and its present and future plans especially for Arctic data buoys are discussed. ESRO

N74-11242 National Oceanic and Atmospheric Administration, Silver Spring, Md. Environmental Data Service.
HYDROCLIMATOLOGY AS A FACTOR IN THE DESIGN OF OCEAN DATA ACQUISITION SYSTEMS (ODAS)
R. M. Morse *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 250-265 refs (For availability see N74-11219 02-13)

The importance of hydroclimatology as a systems design approach to ocean data acquisition systems is illustrated by examples from ongoing U.S. oceanographic programs and international programs having major U.S. involvement. ESRO

N74-11243 General Dynamics Corp., San Diego, Calif. Electro Dynamic Div.
ECONOMIC TRADEOFFS OF OCEAN DATA BUOY SIZE AND NETWORK OPERATIONAL STRATEGIES
C. D. Nelson and R. V. Woodle *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 266-282 (For availability see N74-11219 02-13)

The analysis of system cost effectivenesss is described which can be helpful in planning an optimum ocean data collection system utilizing buoys. Certain important questions such as hull, payload, and servicing that must be addressed to the systems designer in the planning stage are identified. ESRO

N74-11244 Tsurumi Precision Instruments Co. Ltd., Yokohama (Japan).
SUB-SURFACE TEMPERATURE OBSERVATION BY REVERSING THERMOMETER, BT, XBT AND STD **c14**
H. Iwamima and M. Sekimoto *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 283-289 (For availability see N74-11219 02-13)

The background to water temperature measuring instruments is reviewed, and four instrument types for sea water temperature measurement are described. These are the reversing thermometer; the bathythermograph; the expendable bathythermograph; and electronic sensors. These sensors consist mainly of three systems for converting temperature into an electrical amount including dc systems, FM systems, and digital systems. The advantages and disadvantages of each system are discussed. ESRO

N74-11245 Miami Univ., Coral Gables, Fla. National Hurricane Research Lab.
USE OF SATELLITE INFRARED IMAGERY, AIRBORNE EXPENDABLE BATHYTHERMOGRAPHS AND AIRBORNE PRECISION INFRARED THERMOMETERS TO INFER THE MUTUAL INTERACTION OF HURRICANES AND THE UPPER MIXED LAYER OF THE OCEAN
P. G. Black and W. D. Mallinger *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 290-314 refs (For availability see N74-11219 02-13)

It is shown that use of remote sensing methods such as satellite-borne, medium resolution, infrared radiometers; aircraft-borne, precision infrared thermometers; and expendable bathythermographs can be used to improve detection of the sea surface and sub surface temperature patterns. These tools are described and shown to be helpful in determining changes in tropical storm and hurricane intensity due to changes in sea surface temperature. ESRO

N74-11246 Japan Meteorological Agency, Tokyo. Meteorological Research Inst.
ON THE PLAN OF AMTEX OBSERVATIONAL PROBLEMS **c20**

M. Magata *In* WMO Means of Acquisition and Commun. of Ocean Data; Vol. 2 1973 p 315-325 refs (For availability see N74-11219 02-13)

The aims of the air mass transformation experiment (AMTEX), a subprogram of GARP, are outlined. In order to solve the problems inherent in these aims, AMTEX is planned to carry out systematic meteorological observations which include boundary layer, cumulus convection and ocean studies, around the southwest islands of Japan. The problems and observations are discussed. ESRO

N74-11247 Scripps Institution of Oceanography, La Jolla, Calif.

TIME AND SPACE SCALES OF OCEAN TEMPERATURE RELATIONSHIPS

C. K. Stidd and R. M. Borne *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 326-332 refs (For availability see N74-11219 02-13)

Buoys have recorded surface weather elements and ocean temperatures at ten levels to a depth of 300 m in the Central North Pacific Ocean. Concurrent records for various period lengths were obtained at buoy spacings ranging from 5 km to 2000 km. Annual cycles were removed from the various data, and numerous serial- and cross-correlations have been computed using several averaging periods to provide a preliminary inspection of the scales of motion and variability in the upper 300 m of the ocean. The decrease of correlation with distance and time shows that ocean temperature patterns tend to be on a larger scale and to be more persistent in time than atmospheric patterns. Averaging does not reduce the variance of ocean data as much as it does atmospheric data. This indicates that a smaller proportion of the variance is contained in the shorter wave lengths and that, with less chance for aliasing, ocean measurements are more reliably representative of large areas than are atmospheric measurements. Author (ESRO)

N74-11248 Scripps Institution of Oceanography, La Jolla, Calif.

THE NORTH PACIFIC EXPERIMENT: A STUDY OF LARGE SCALE OCEAN AND ATMOSPHERE FLUCTUATIONS IN THE PACIFIC **c20**

T. P. Barnett *In* WMO Means of Acquisition and Commun. of Ocean Data Vol. 2 1973 p 333-344 refs (For availability see N74-11219 02-13)

(Contract N00014-69-A-0200-6006; Grant NSF GX-32481)

The North Pacific Experiment (NORPAX) which will be directed towards describing and understanding the interactions of the ocean/atmosphere systems in the North Pacific Basin, is described. The study will necessitate a data acquisition program capability of simultaneously monitoring selected geophysical fields in various areas of the Pacific Basin. The program will utilize data from moored and drifting buoys, ships, island stations, satellites and aircraft. The background, program, participation, and organization of the experiment are discussed. ESRO

N74-11249 Servicio de hidrografia Naval Armada Argentina, Buenos Aires.

REQUIREMENTS FOR OCEAN DATA IN ARGENTINA [NECESIDADES EN MATERIA DE DATOS OCEANICOS]

A. J. Valdez and N. W. Lanfredi *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 345-353 refs In SPANISH (For availability see N74-11219 02-13)

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The oceanographic program of Argentina which is designed to study the southern Atlantic sub-tropical and sub-antarctic water circulation at different times of the year is described. The oceanographic parameters - salinity, water temperature and ocean currents - to be studied are considered and the measuring instruments and launching and recovery of the data collection platforms noted. The operations necessary to comply with the objectives of the program are discussed. ESRO

N74-11250 World Meteorological Organization, Geneva (Switzerland).

TEMPERATURE AND PRESSURE TRANSDUCERS FOR MOORED AND DRIFTING BUOYS **c14**

M. W. Shedlov *In its* Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 354-364 (For availability see N74-11219 02-13)

The designs of air temperature transducers accurate to + or - 0.1 C, water temperature transducers accurate to + or - 0.01 C, and barometric pressure tranducers accurate to + or - 0.6 mb are discussed. Particular emphasis is placed on choice of proper materials to ensure the sensing elements experience no strain over the design ranges while maintaining resistance to the corrosive effects of a salt water environment. An advanced water temperature transducer with a time response of 0.060 seconds and a pressure capability to 2250 kg/sq cm is also discussed. Author (ESRO)

N74-11251 Westinghouse Electric Corp., Annapolis, Md. Oceanic Div.

NATIONAL DATA BUOY SENSOR SYSTEM **c20**

G. A. Gilmour and R. H. Cassis *In* WMO Means of Acquisition and Commun. of Ocean Data; Vol. 2 1973 p 365-377 (For availability see N74-11219 02-13)

The engineering experimental phase (EEP) buoy of the U.S. National Data Buoy program is described. The overall purposes of the buoy - measurement of oceanographic and meteorological parameters - are described and the parameters themselves noted. The buoy system description is given together with an analysis of features and new technology. Typical modes of operation are included. ESRO

N74-11252 National Ocean Survey, Bay St. Louis, Miss.

DETERMINATION OF TOTAL OBSERVATIONAL ERROR IN ENVIRONMENTAL DATA FROM OCEAN MEASUREMENT PLATFORMS

G. W. Withee and L. M. Clem *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 379-389 refs (For availability see N74-11219 02-13)

The use of error analysis programs in determining the total observational error in environmental data from ocean measurement platforms is discussed. The total observational error and its components are defined and two programs to determine these errors are summarized. The programs consist of both at-sea ground truth measurement experiments and the development of a generalized computer simulation model of total observational error and its components. The application of the simulation program is discussed. The program can serve as a check on data quality, to evaluate design concepts, and to recommend refinements to improve data quality in a particular parameter measured on a data buoy. ESRO

N74-11253 Admiralty Underwater Weapons Establishment, Portland (England).

A DIRECTIONAL WAVE BUOY FOR MEASURING THE SMALL SCALE IRREGULARITIES OF THE SEA SURFACE

D. J. Dunn *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 390-395 refs Prepared jointly with Marconi Space and Defence Systems, Ltd. (For availability see N74-11219 02-13)

A wave buoy was developed to obtain sea surface statistics over a wide frequency range; the buoy being required to measure both the long wavelengths associated with the swells in the ocean and also the shorter wavelengths extending only a few centimetres. The necessary dynamic range was achieved by using two measuring systems, each working over a limited frequency range. The motion of the buoy is monitored to define the long wavelength components and a directional probe array mounted on the buoy determines the short wavelength components. Measurements were obtained over the wavelength scale 2 cm to 150 m. with a dynamic range of 80 db. Author (ESRO)

N74-11254 Ministry of Defence, London (England). Meteorology and Oceanographic Services.

ON THE MEASURING OF SEA SURFACE TEMPERATURE **c14**

R. R. Fotheringham *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 396-409 (For availability see N74-11219 02-13)

The characteristics of the sea surface mixed layer are described and four types of instrument currently in use to measure the temperature of the layer are discussed. The methods are sea bucket, intake thermometers, trailing thermistors, and hull attached

thermometers. The advantages and disadvantages of each method are summarized and compared. ESRO

N74-11255 Maritime Weather Office, Cape Town (South Africa).
SEA-SURFACE TEMPERATURE BY DIRECT SAMPLING c14
A. B. Crawford *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 410-424 (For availability see N74-11219 02-13)

Programs in the designing of special instruments to measure sea surface temperature by direct sampling methods, are reviewed. Five instruments are described - three remote reading electronic thermometers and two sea buckets. A comparison is made and results and costs are given. ESRO

N74-11256 Atmospheric Environment Service, Downsview (Ontario).
A PROPOSED SHIPBOARD METEOROLOGICAL DATA SYSTEM c20
R. E. Vockeroth and J. M. Cook *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 426-437 refs (For availability see N74-11219 02-13)

A simple system for the measurement and display of shipboard meteorological data in digital form is proposed. By using two orthogonal wind speed sensors, aligned along and across the vessel's centerline, the errors that the ship's motion induces in conventional cup-wheel and vane anemometers would be largely eliminated. From these sensors, and manually inserted settings of the ship's speed and heading, simple analog circuits can compute the true mean wind speed and direction. These values, together with those for air temperature, dew point and water temperature are displayed digitally on demand. Author (ESRO)

N74-11257 National Environmental Satellite Service, Suitland, Md.
MARINE APPLICATIONS OF THE US ENVIRONMENTAL SATELLITE PROGRAM
H. W. Yates *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 438-466 refs (For availability see N74-11219 02-13)

The use of satellites as observation platforms for meteorological and oceanographic parameters is discussed. The types of orbit best suited to satellites - polar and geostationary - are described and the methods of collecting data while in these orbits are considered. The limitations of satellite observations for oceanologic studies are noted. The parameters to be observed and measured are detailed and the instruments and their operation are described. Experiments in the observation of sea ice, sea temperature, cloud temperature and wind field are discussed. ESRO

N74-11258 Laboratoire de Meteorologie Dynamique, Paris (France).
THE EOLE EXPERIMENT c20
P. Morel *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 471-491 refs (For availability see N74-11219 02-13)

The preliminary results of the EOLE experiment are presented. The principle of the experiment is to collect meteorological data especially relating to atmospheric circulation from a large number of automatic instrument stations operating in the atmosphere either on the ocean surface or aloft (constant level balloons). The design of the system is described and the Southern Hemisphere mean circulation at 200 mb during the EOLE experiment discussed. The general circulation as a quasi two-dimensional turbulent flow is estimated and divergence of the horizontal flow at 200 mb is indicated. Marine applications of EOLE are considered. ESRO

N74-11259 Ministry of Posts and Telecommunications, Tokyo (Japan). Radio Research Labs.
AN ANALOG RECEPTION OF THE SSCC PICTURES c20
O. Ryuguji and H. Tanaka *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 492-498 (For availability see N74-11219 02-13)

A description of the ATS 1 spacecraft and the spin scan cloud camera (SSCC) which can take high resolution pictures for synchronous altitude over the Pacific Ocean is given. The characteristics of the communication system are noted and the design of the SSCC signal processing system discussed together with analog to digital conversion of the SSCC signal. ESRO

N74-11260 Equipment Development Lab., Silver Spring, Md.
NEXAIR: DEVELOPMENT OF A NEW UPPER-AIR SOUNDING SYSTEM c20
J. Lovkay, Jr. and R. H. Waters *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 499-547 refs (For availability see N74-11219 02-13)

The background to the setting up of NEXAIR (next generation upper-air system) is reviewed and the system requirements and operating characteristics are given. The two basic parts, the flight and ground subsystems are discussed in detail and the various elements such as balloon, temperature and pressure sensors, telemetry and processing systems, described. While the design and development of NEXAIR are not yet complete, certain results are presented and cost estimates are given. ESRO

N74-11261 Meisei Electric Co. Ltd., Tokyo (Japan).
COMPUTER-AIDED SHIPBOARD UPPER-AIR OBSERVATION SYSTEM c20
T. Kurashige *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 548-558 (For availability see N74-11219 02-13)

A fully transistorized automatic tracking radar set for use onboard ships is described which has been developed to track echosondes, echorawins, rawinsondes or rawins. The equipment specifications are given in detail and the compensation for ship motion is discussed. The receiving and recording equipment is described and radiosonde and rawin observation modes are discussed. ESRO

N74-11262 Meteorological Office (Gt. Brit.).
RADIO-SONDE OBSERVATIONS FROM MERCHANT SHIPS c20
M. E. Robson *In* WMO Means of Acquisition and Commun. of Ocean data, Vol. 2 1973 p 559-563 (For availability see N74-11219 02-13)

The selection of equipment and the advantages of using the German Graw sonde are discussed. The program of soundings is given and it is shown that one meteorologist alone can maintain this program. The technique of actually making the observations is examined with emphasis on methods for overcoming the difficulties of launching balloons from merchant ships. A summary of the results of recent voyages is given which shows that despite obvious difficulties the failure rate is encouragingly low. The article concludes with general comments and advice based upon experience gained in operating radio sonde ascents from merchant ships since February 1968. Author (ESRO)

N74-11263 National Center for Atmospheric Research, Boulder, Colo.
ATMOSPHERIC MEASUREMENTS OVER THE TROPICAL OCEANS USING SUPERPRESSURE BALLOONS c20
V. E. Lally *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 564-566 refs (For availability see N74-11219 02-13)

The use of the superpressure balloon to determine the wind field in the tropical stratosphere and the atmospheric circulation in the Southern Hemisphere is discussed. The carrier balloon vehicle is described together with the communication system. The need for compatible data collection systems is discussed and the cost of carrier balloon soundings estimated. ESRO

N74-11264 Reading Univ. (England). Dept. of Geophysics.
THE OPERATION OF RADIOSONDES IN THE BOUNDARY LAYER OVER THE SEA c20
G. P. Britton *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 567-581 (For availability see N74-11219 02-13)

A method is described whereby remote sensing of the lowest layers of the atmosphere over the ocean is achieved by radiosondes. The method is an extension of the principle whereby after a time interval the sonde returns to the sea surface as a drop sonde permitting two or more transits of the boundary

layer so that at least two, and usually four, sets of independent soundings can be obtained. The various components of the system - release mechanisms, float, pressure valve - are described as well as the radiosonde itself. The problems of windfinding are considered and some cases of variation in rates of ascent and descent are given. ESRO

N74-11265 National Oceanic and Atmospheric Administration, Boulder, Colo.
A NOTE ON THE FM-CW RADAR AS A REMOTE PROBE OF THE PACIFIC TRADE WIND INVERSION c20
B. R. Bean, R. E. McGavin, and B. D. Warnert *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 582-593 refs (For availability see N74-11219 02-13)

A vertically pointed FM-CW radar was used to monitor the Pacific trade wind inversion in the Hawaiian Islands during the summer of 1971. An instrumented aircraft was used for in-situ measurements of radio refractivity and temperature. The correspondence between the position of the radar returns and the aircraft data was excellent. The strong returns seen by the radar were due chiefly to the strong lapse of humidity across the inversion. The radar indicated that over the island of Lanai the trade wind inversion was highly variable both in position and intensity. At times the layer would move from above 2 km to less than 1 km in the space of five minutes associated with strong mechanical turbulence. Its thickness would change rapidly from tens of meters to hundreds of meters. Wave-like structure induced by the mountains on the east side were observed by the radar. The analysis indicates the interpretation of in-situ aircraft measurements may be greatly aided by using the FM-CW radar as a guide. Author (ESRO)

N74-11266* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH RESOLUTION SYSTEM FOR UPPER AIR (TROPOSPHERE) WIND AND TEMPERATURE PROFILE MEASUREMENTS c20
D. W. Camp and W. W. Vaughan *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 594-600 refs (For availability see N74-11219 02-13)

The Jimsphere/Jimsonde system is described and some possible applications of the system for air-sea interface measurements are presented. As space vehicles became larger and more sophisticated, an improved method for obtaining wind profile data had to be found. To satisfy this need the FPS-16 radar/Jimsphere system was developed. The Jimsphere is an aluminized mylar spherical balloon, two meters in diameter. The balloon is under superpressure, and is tracked with a high precision radar system. The development of this detailed wind profile system was started in 1963, and the present design was established in 1964. To improve the system, a program was initiated in 1965 to obtain high resolution temperature data simultaneously with the wind profile data. Author (ESRO)

N74-11267# Ruhr Univ., Bochum (West Germany). Abteilung fuer Physik und Astronomie.
DETERMINATION OF THE 4 STOKES PARAMETERS OF SCATTERED SOLAR RADIATION [MESSUNG DER 4 STOKES-PARAMETER GESTREUTER SOLARER STRAHLUNG]
Dieter Hannemann Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1973 90 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBW-73-14) Avail: NTIS HC $6.50; ZLDI, Munich 18,50 DM

A novel polarimeter for the determination of the 4 Stokes parameters of solar radiation scattered by the atmosphere is described. The wave length range is 600 - 1000 nm. The 4 Stokes parameters were obtained from simultaneous measurements of 6 radiation densities. The maximum frequency of measurements was 1000/sec. The theory of measurements and calibrations is discussed. Some measurements of downward scattered skylight at a cloudless but turbid atmosphere are discussed and compared with calculations of other authors. Most of the measurements were made at Bochum where a high aerosol concentration is typical. Some theoretical predictions are not confirmed by the measurements. The measurements show an important asymmetry in the direction of polarization with respect to the sun's vertical at 600 and 800 nm wave length. The maximum ellipticity in a typical measurement is about 20 % at 800 nm, whereas the theoretical computations gives values smaller than 1%. Author (ESRO)

N74-11268# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF CASES OF POWERFUL TURBULENCE IN THE TROPOSPHERE
A. A. Vasilev and N. N. Chuchkalova 10 Aug. 1973 16 p refs Transl. into ENGLISH from Analiz. Meteorol. Uslovii dlya Aviatsii (USSR), no. 95, 1972 p 36-43
(AD-766565; FTD-MT-24-746-73) Avail: NTIS CSCL 04/2

The report gives an analysis of zones of powerful turbulence as recorded by KZ-63 recorders (threshold of response 0.2 g) on civil aviation IL-18 flights from December of 1967 through December of 1968. GRA

N74-11269# California Univ., Riverside. Inst. of Geophysics and planetary physics.
A STUDY OF EQUATORIAL INNER BELT PROTONS FROM 2 TO 200 MeV
E. S. Claflin and R. S. White 6 Aug. 1973 35 p refs
(Contract N00014-69-A-0200-5001)
(AD-766463; IGPP-UCR-73-39; TR-11) Avail: NTIS CSCL 04/1

The diffusion theory of inner belt protons is extended to lower energies for comparison with the data of Hovestadt et al. The effects of Coulomb energy loss, nuclear inelastic scattering, and the secular decrease of the earth's magnetic field are included. The Farley and Walt solar cycle averaged atmosphere and a neutron source based on the most recent measurements are used. It is found that diffusion theory can account for the observed flux of low energy protons provided that the diffusion coefficient increases at smaller values of the first invariant. This result is interpreted as additional evidence for the importance of electrostatic field fluctuations in causing radial diffusion. It is also found that the excess of protons predicted by the theory at and above 400 MeV/gauss cannot be attributed to pitch angle scattering. Increasing the free electron density by a factor of 5 improves agreement between theory and experiment. Author (GRA)

N74-11270# Stanford Univ., Calif. Dept. of Civil Engineering.
WAVE-INDUCED PERTURBATIONS IN A TURBULENT BOUNDARY LAYER OVER PROGRESSIVE WATER WAVES
Hsi Yen Yu, En Yun Hsu, and Robert L. Street Jul. 1973 149 p refs
(Contract N00014-67-A-0112-0059; Grant NSF GK-31809X)
(AD-767025; SU-TR-172) Avail: NTIS CSCL 08/3

The structures of the wave-induced perturbations in a turbulent boundary layer over a mechanically generated monochromatic wave-train were experimentally investigated. Both the amplitude and phase of the wave-induced pressure and the two wave-induced velocity components were studied. The wave-induced Reynolds stress and the power input were computed. The magnitude of each term in the governing energy-balance equation was evaluated through the measured values. It was found that each of the wave-induced pressure and velocity components has certain phase and amplitude distribtuion with respect to the distance from the wave surface. Each also varies with the ratio of the mean wind speed and the wave celerity. An effort was made to evaluate the integral energy balance equation through the experimental data. (Modified author abstract) GRA

N74-11271# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
CHARACTERISTICS OF THE AUGUST 1972 SOLAR PARTICLE EVENTS AS OBSERVED OVER THE EARTH'S POLAR CAPS
Joseph B. Reagan, William L. Imhof, and Vincent F. Moughan Jun. 1973 25 p refs
(Contract N00014-70-C-0203; NR Proj. 087-135)
(AD-766465; LMSC-D352207) Avail: NTIS CSCL 04/1

The fluxes and spectra of solar protons in the energy range 1-100 MeV have been measured over the earth's polar caps at an altitude of 800 km aboard the satellite 1971-089A during the intense solar particle events of 3-12 August 1972. Differential

proton fluxes in the energy intervals 1-4.5 MeV, 5-20 MeV and 20-100 MeV are presented as a function of time throughout the events. The fluxes of 0.76-2.1 MeV energetic electrons are also presented. Differential spectra of protons, alpha particles and electrons over the south central polar cap are shown for 1102 UT on 4 August and 0144 UT on 9 August 1972. Comparisons of the peak and integrated fluxes measured in this experiment with another measurement made during these events and with other large events in the previous solar cycle have been made. The 29-100 MeV proton fluxes measured over the polar caps in this experiment are in good agreement with the greater than 30-MeV proton measurements of Bostrom et al. (1972) made in interplanetary space and in the magnetosphere. The present data indicate that the 4 August 1972 event was the largest solar particle event observed near earth in the last two decades. Author (GRA)

N74-11272# Massachusetts Inst. of Tech., Cambridge.
GENERATION AND PROPAGATION OF INFRASONIC WAVES Final Report, 1 Feb. 1970 - 31 Jan. 1973
Allan D. Pierce, Charles A. Moo, and Joe W. Posey 30 Apr. 1973 131 p refs
(Contract F19628-70-C-0008; AF Proj. 7639)
(AD-766472; AFCRL-TR-73-0135) Avail: NTIS CSCL 04/2

A review is given of theoretical studies on infrasound generation and propagation through the atmosphere which were carried out under the contract. These studies include (1) further development and application of a computer program for the prediction of pressure signatures at large distances from nuclear explosions, (2) development of an alternative approximate model for waveform synthesis based on Lamb's edge mode, (3) development of a geometrical acoustics: theory incorporating nonlinear effects, dispersion, and wave distortion at caustics, and (4) a theoretical model for the prediction of acoustic gravity wave generation by rising and oscillating fireballs. Numerical studies are reviewed which indicate the dependence of far field waveforms on energy yield and burst height. Implications of the Lamb edge mode theory include a new method for estimating energy yield from waveforms and an explanation of amplitude anomalies in terms of focusing or defocusing of horizontal ray paths. Author (GRA)

N74-11273# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EXPERIMENTAL EVIDENCE FOR THE CONNECTION BETWEEN THE GEOMAGNETIC AND THE INTERPLANETARY FIELDS AS DETERMINED FROM OBSERVATIONS OF ENERGETIC SOLAR PARTICLES
G. A. Paulikas 15 Sep. 1973 50 p refs
(Contract F04701-73-C-0074)
(AD-766715; TR-0074(4260-01)-1; SAMSO-TR-73-257) Avail: NTIS CSCL 08/14

Recent measurements of energetic solar particles have shown that a direct connection exists between the geomagnetic field and the interplanetary magnetic field. The access window for 300 keV solar protons that reach the center of the polar cap may be as near as 150 R(e) in the downstream magnetotail; access windows of solar protons, which precipitate into the atmosphere at latitudes near the geomagnetic cutoff, may be as near as 30 R(e). Comparison of the patterns of auroral particle precipitation with the zones of access of energetic solar electrons and protons indicates that a substantial fraction of the aurora originates on field lines connected to the interplanetary field. Author (GRA)

N74-11274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENCE NEAR THE TROPOPAUSE IN THE PRESENCE OF MOUNTAIN WAVES
G. S. Buldovskii 10 Aug. 1973 18 p refs Transl. into ENGLISH from Analiz Meteorol. Uslovii dlya Aviatsii (USSR), no. 95, 1972 p 17-26
(AD-766577; FTD-MT-24-744-73) Avail: NTIS CSCL 04/2

Investigation of the conditions for the development of turbulence near the tropopause, especially above a mountainous region, has great current significance in connection with the forthcoming flights of supersonic passenger aircraft. Near the tropopause there will be a transition zone to supersonic speed. The report discusses research on the conditions of turbulence near the tropopause above mountainous regions and simultaneous distribution of turbulence in the troposphere and the lower stratosphere. GRA

N74-11275# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AUTOMATION OF A MODEL FOR PREDICTING SOIL MOISTURE AND SOIL STRENGTH (SMSP MODEL) Final Report
Margaret H. Smith and Marvin P. Meyer Jan. 1973 274 p refs
(DA Proj. 4A6-63712-D-860)
(AD-755095; AEWS-Misc-Paper-M-73-1) Avail: NTIS CSCL 08/13

The soil moisture strength prediction (SMSP) model is a composite of the methods developed at the U.S. Army Engineer Waterways Experiment station for predicting daily soil moisture contents and strengths (in terms of cone index and rating cone index) of soil layers at depths of 0-15 and 15-30 cm. Information required by the model includes soil moisture accretion and depletion relations, field maximum and minimum soil moisture contents, moisture content at start of prediction, soil dry density, soil moisture-strength relation, daily rainfall amounts, and minimum rainfall amount required for acretion. The main text of the report includes a discussion of the structure, operation, use limitations, and mathematics of the model. Appendixes A-G include detailed flow charts and listings of the computer program (listings, organization, and format of input data) examples of prediction runs and graphic displays of results, and procedures for converting output data to terms required by the airfield construction effort model. Author (GRA)

N74-11276# Lowell Technological Inst. Research Foundation, Mass.
DATA ACQUISITION AND RETRIEVAL SYSTEM FOR A GEODETIC RANGEFINDER Final Report, 1 Jun. 1972 - 31 May 1973
Sumner Ackerman Jun. 1973 51 p refs
(Contract F19628-72-C-0328; AF Proj. 7600)
(AD-766460; LTIRF-359/ACK; AFCRL-TR-73-0401) Avail: NTIS CSCL 08/5

An instrument has been developed to measure, digitalize and store the amplitudes of signal pulses from an optical rangefinder. The pulses may be as short as 5 x 10 to the minus 9th power seconds in duration, 12 x 10 to the minus 6th power seconds or more apart, and may have peak values from 20 to 2,400 millivolts. These pulse amplitude measurements, and the related range-time interval and fiducial time data, are retrieved on paper tape. Format characters are inserted so that the TTY printout is in a convenient form for study or editing. This equipment is expected to reduce the preprocessing of geodetic range information accumulated during the orbital pass of a geodetic satellite from one man-week to three or four man-hours. The use of a D17B (Minuteman) computer for data processing and retrieval tasks at the AFCRL geodetic rangefinder station was studied. It was determined that this computer is not well suited to these applications. Author (GRA)

N74-11277# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
GEOMAGNETICALLY TRAPPED ALPHA PARTICLES. THE INNER ZONE Report for May - Feb. 1973
J. Bernard Blake, Joseph F. Fennell, Michael Schulz, and George A. Paulikas 28 Sep. 1973 38 p refs
(Contract F04701-73-C-0074)
(AD-766408; TR-0074(4260-20)-2; SAMSO-TR-73-256) Avail: NTIS CSCL 04/1

The inner-zone population of trapped alpha particles in the energy range 2.14-9.0 MeV was measured during 1969. The measurements show that inner-zone alpha particles are strongly peaked in pitch angle and the intensity decreases rapidly with decreasing L value. The alpha-particle spectra are flat and closely resemble inner-zone proton spectra at comparable energies. The alpha/p ratio is roughly independent of L (1.6 approximately $<$ L approximately $<$ 2.0) and energy (0.293-1.14 MeV/nucleon) and is approximately 1-4 X 0.001. The computed alpha-particle distribution function strongly suggests that the inner zone is

populated by alpha particles which diffuse inward conserving M and J. A value of the diffusion coefficient is derived, D(LL) + or - (1.2 x 10 to the minus 8th power) (L to the 10th power)/day, which is in good agreement with earlier proton studies.
Author (GRA)

N74-11278# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
SOME PROBLEMS IN GEOPHYSICS
J. J. Stoker Apr. 1973 165 p refs
(Contract N00014-67-A-0467-0030; NR Proj. 041-446)
(AD-766827; IMM-394) Avail: NTIS CSCL 04/2

Contents: The gyroscopic motions of the earth; Flood waves in rivers and reservoirs; Frontal motion in the atmosphere; Mountain winds; Atmospheric predictability; Geostrophic vortex motion and applications; The upper boundary condition for gravity waves in the atmosphere; Numerical simulation of the life cycle of tropical cyclones; A mountain building model; Turbulence; Progressive gravity waves on a sphere; Turbulence spectra and vortex formation; Dynamo theory; Linear and nonlinear magneto-elastic wave motion; Viscosity of the earth's crust; Nonexistence of shear waves in the earth's core; Gravity waves in a thin sheet of viscous fluid; Temperature profile of the solar wind. GRA

N74-11279# Scripps Institution of Oceanography, La Jolla, Calif. Advanced Ocean Engineering Lab.
MICROPROCESSES, PART 1. MIDWATER THERMAL STRUCTURE, PART 2. SURFACE WAVES AND NEAR SURFACE EFFECTS, PART 3 Technical Progress Report, 1 Jan. - 30 Jun. 1973
Charles S. Cox, James L. Cairns, Frank H. Champagne, Carl A. Friehe, and Carl H. Gibson 14 Aug. 1972 31 p refs
(Contract N00014-69-A-0200-6039; ARPA Order 2185)
(AD-766151; AOEL-41; SIO-Ref-73-20-Pt-1-2-3) Avail: NTIS CSCL 08/10

The semi-annual report reflects the technical status of internal/surface wave interaction and microstructure projects conducted within the Advanced Ocean Engineering Laboratory at the Scripps Institution of Oceanography. These projects are: Thermal Microstructure - to examine in detail the structure and dynamics of temperature and salinity; and Atmospheric Boundary Layer - to provide an understanding of the interaction between atmospheric boundary effects and surface waves. Author (GRA)

N74-11280*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AN ERTS VIEW OF ALASKA, A REGIONAL ANALYSIS OF EARTH AND WATER RESOURCES BASED ON SATELLITE IMAGERY
Duwayne M. Anderson, William K. Crowder, Lawrence W. Gatto, Richard K. Haugen, Thomas L. Marlar, Harlan L. McKim, and Anthony Petrone Jun. 1973 84 p refs
(NASA Order S-70253-AG)
(NASA-CR-136073; AD-765442; CRREL-TR-241) Avail: NTIS HC $6.25 CSCL 08/6

A preliminary study has been made of the value of satellite imagery in synoptic surveys of the distribution and environmental interrelationships of permafrost terrain and of coastal sedimentation and related processes in Cook Inlet, Alaska. Earth Resources Technology Satellite multispectral scanner (MSS) imagery was the primary data source for this investigation. Aerial underflight imagery and ground observations of selected sites were secondary data sources. Emphasis has been placed on evaluating the feasibility of mapping permafrost terrain from textural and tonal patterns related to surficial geology and vegetation. A mosaic of a 153,400-sq. km. area in north-central Alaska has been prepared at a scale of 1:1 million. Seven surficial geology, eight vegetative cover and four permafrost terrain units were defined and delineated. Many geomorphic features were also recognized: thaw lakes, stream drainage patterns, glacial moraines, cirques, abandoned glacial valleys and volcanic cones. Preliminary analysis of the regional hydrologic and oceanographic processes in Cook Inlet has been accomplished. It is evident that the distribution of sediments and regional circulation patterns can be monitored using satellite imagery. Author (GRA)

N74-11281# Aerospace Corp., El Segundo, Calif.
THE EFFECT OF STRONG PITCH-ANGLE SCATTERING ON THE LOCATION OF THE OUTER-ZONE ELECTRON BOUNDARY AS OBSERVED BY LOW ALTITUDE SATELLITES Technical Report, Feb. 1972 - Feb. 1973
Alfred L. Vampola 28 Sep. 1973 31 p refs
(Contract F04701-73-C-0074)
(AD-766414; TR-0074(4260-20)-3; SAMSO-TR-73-269) Avail: NTIS CSCL 04/1

Using simultaneous observations of low altitude energetic electron fluxes from the magnetic electron spectrometer on OV3-3 and equatorial electron fluxes observed by ATS-1, a recently identified strong pitch-angle scattering mechanism is shown to be a low altitude phenomenon only. The relationship between this scattering process and the apparent location of the outer-zone energetic electron boundary as observed by low altitude polar-orbiting satellites is demonstrated. The process explains observations of rapid electron boundary motions during geomagnetically quiet times. In addition, by assuming the process also explains the energetic electron spike sometimes seen at the apparent outer-zone cutoff, the magnitude of the spike itself is used to determine the high altitude limit of the rapid scattering region. Author (GRA)

N74-11282# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF SEA STATE ON BRIGHTNESS TEMPERATURE
A. E. Basharinov and A. M. Shutko 31 Jul. 1973 27 p refs
Transl. into ENGLISH Akad. Nauk SSSR, Inst. Radiotekhn. i Elektroniki, report, 1971 p 1-29
(AD-765996; FTD-HT-23-001-74) Avail: NTIS CSCL 08/3

The authors present the results of experimental studies and appropriate model calculations of the characteristics of the thermal radiation field of a water surface in the shf range - the average values of emittance, the degree of polarization, and the space-time variations of radiation intensity. Measurements made at a coastal point on the 0.8, 1.35, 1.6, 3.2, and 3.37-cm bands from on board an aircraft on the 3-cm band, and aboard the Kosmos-243 satellite on the 0.8, 1.35, 3.4, and 8.5-cm bands made it possible to obtain dependences of the radiation characteristics on the force of sea swells. Observations from the coastal region and aboard the aircraft were performed with wind speeds to 5-7.5 m/s, those from the Kosmos-243 - to 15-20 m/s. GRA

N74-11400+ National Inst. for Hydrology and Meteorology, Warsaw (Poland).
VISTULA RIVER POLLUTION PROBLEMS AS RELATED TO THE RIVER'S HYDROLOGICAL REGIME
E. Bobinski *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 133-140 ref Presented at 6th WMO Congr. (For availability see N74-11381 02-20)
Avail: NTIS

N74-11401 World Meteorological Organization, Geneva (Switzerland).
POLLUTION ASPECTS OF INLAND WATERS
In its Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 141-143 (For availability see N74-11381 02-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-11283* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMAGE DATA RATE CONVERTER HAVING A DRUM WITH A FIXED HEAD AND A ROTATABLE HEAD Patent
Frederic C. Billingsley, inventor (to NASA) Issued 6 Nov. 1973 5 p Filed 22 Feb. 1972 Supersedes N72-22453 (10-13,

p 1749) Sponsored by NASA
(NASA-Case-NPO-11659-1; US-Patent-3,770,903; US-Patent-Appl-SN-228189; US-Patent-Class-179-100.2MD; US-Patent-Class-178-6.6DD; US-Patent-Class-179-100.2T; US-Patent-Class-340-174.1L) Avail: US Patent Office CSCL 14C

A data-rate converter is disclosed comprising a rotatable data-storing drum with at least one fixed read/record head and a rotatable read/record head. The latter is rotatable in a circular path about the drum axis of rotation. The drum is positionable in any one of a plurality of axial positions with respect to the heads, so that at least one drum track is aligned with the fixed head in one drum position and with the rotatable head in another drum position. When a track is aligned with the fixed head, data may be recorded therin or read out therefrom at a rate which is a function of drum rotation, while when aligned with the rotatable head, data may be recorded or read out at a rate which is a function of the rates and directions of rotation of both the drum and the head.
Official Gazette of the U.S. Patent Office

N74-11284* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MONITORING ATMOSPHERIC POLLUTANTS WITH A HETERODYNE RADIOMETER TRANSMITTER-RECEIVER Patent
Robert T. Menzies, inventor (to NASA) Issued 16 Oct. 1973 9 p Filed 24 Mar. 1972 Supersedes N73-29436 (11 - 20, p 2419) Sponsored by NASA
(NASA-Case-NPO-11919-1; US-Patent-3,766,380; US-Patent-Appl-SN-237694; US-Patent-Class-250-343) Avail: US Patent Office CSCL 14B

The presence of selected atmospheric pollutants can be determined by transmitting an infrared beam of proper wavelength through the atmosphere, and detecting the reflections of the transmitted beam with a heterodyne radiometer transmitter-receiver using part of the laser beam as a local oscillator. The particular pollutant and its absorption line strength to be measured are selected by the laser beam wave length. When the round-trip path for the light is known or measured, concentration can be determined. Since pressure (altitude) will affect the shape of the molecular absorption line of a pollutant, tuning the laser through a range of frequencies, which includes a part of the absorption line of the pollutant of interest, yields pollutant altitude data from which the altitude and altitude profile is determined. Official Gazette of the U.S. Patent Office

N74-11285 Paris Univ. (France). Lab. de Chimie Organique Physique.
FUNDAMENTAL RESEARCH IN ULTRAFAST SPECTROMETRY [RECHERCHES FONDAMENTALES EN SPECTROMETRIE ULTRA-RAPIDE]
F. Garnier Dec. 1972 24 p In FRENCH
(Contract DGRST-71-7-2643)
Avail: Issuing Activity

The evaluation of an ultrafast spectrophotometer for reaction kinetics analysis is presented. The instrument consists of a double grating monochromator, a light amplifier and a vidicon. The charateristics under study were amplification, spectral resolution, photometric precision, response curve, and response time. The results of the various tests performed are detailed and exceptional performance in spectral resolution luminosity and response time are emphasized. Examples of recorded spectra in the fields of fluorescence, phosphorescence, emission and absorption spectroscopy are given. Required improvements in fast digital data acquisition are discussed. ESRO

N74-11286*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
GRADIENT ESTIMATES FROM STEREO MEASUREMENTS FOR A MARTIAN VEHICLE M.S. Thesis
William J. Pfeifer May 1973 70 p refs
(Grant NGL-33-018-091)
(NASA-CR-136070; RPI-TR-MP-32) Avail: NTIS HC $5.50 CSCL 14B

The Martian roving vehicle requires an autonomous obstacle detection and path selection system. A laser range finder will be used to determine the locations of a number of discrete points at distances of 3 to 30 meters from the vehicle. The system might measure angles, ranges or a combination of both types of measurements. Author

N74-11287*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADVANCED SCANNERS AND IMAGING SYSTEMS FOR EARTH OBSERVATIONS
Washington 1973 620 p refs
(NASA-SP-335) Avail: NTIS MF $1.45; SOD HC $3.90 CSCL 14B

Assessments of present and future sensors and sensor related technology are reported along with a description of user needs and applications. Five areas are outlined: (1) electromechanical scanners, (2) self-scanned solid state sensors, (3) electron beam imagers, (4) sensor related technology, and (5) user applications. Recommendations, charts, system designs, technical approaches, and bibliographies are included for each area. K.M.M.

N74-11288*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ERGOMETER CALIBRATOR Patent Application
Raymond L. Gause, inventor (to NASA) Filed 31 Oct. 1973 13 p
(NASA-Case-MFS-21045-1; US-Patent-Appl-SN-411572) Avail: NTIS HC $3.00 CSCL 14B

The invention is directed to an apparatus for accurately calibrating ergometers so that the work rate produced during exercising on the ergometer can be determined accurately. The apparatus can be used to calibrate any ergometer that utilizes a rotating shaft. The apparatus includes a D.C. motor which is coupled directly to a shaft upon which peddles are normally mounted for rotating the ergometer. A torque sensor is coupled to the shaft which indicates the torque required to rotate the shaft. A tachometer is also coupled to the shaft for indicating the speed of rotation of the shaft. The signals from the torque sensor and the tachometer are fed into a power computer which computes the wattage being used by the motor. Thus, by comparing the output signal produced by the power computer with the output signal produced by the ergometer it can be determined if the ergometer is accurately calibrated. NASA

N74-11289*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SURVEY OF MASS ANALYZERS
W. Walding Moore, Jr. and Philip W. Tashbar Nov. 1973 31 p refs
(NASA-TM-X-64792) Avail: NTIS HC $3.75 CSCL 14B

With the increasing applications of mass spectrometry technology to diverse services areas, a need has developed for a consolidated survey of the essential characteristics and features of the various instruments and techniques. This report is one approach to satisfying this need. Information has been collected and consolidated into a format which includes for each approach: (1) a general technique description, (2) instrument features information, and (3) a summary of pertinent advantages and disadvantages. With this information, the potential mass spectrometer user should be able to more efficiently select the most appropriate instrument. Author

N74-11290# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT AND FLIGHT TEST OF THE MULTICHANNEL OCEAN COLAR SENSOR (MOCS) Final Report
P. G. White, K. R. Jenkin, R. C. Ramsey, and M. Sorkin Washington NASA Oct. 1973 174 p refs
(Contract NAS1-10908)
(NASA-CR-2311) Avail: NTIS HC $4.75 CSCL 14B

As part of the Advanced Applications Flight Experiments (AAFE) Program, an imaging spectroradiometer known as MOCS (Multichannel Ocean Color Sensor) was designed, developed and flight tested. This unique instrument was flown on the NASA Convair 990 over various water bodies. The development program, the flight tests, and data analysis are presented. Computer routines developed specifically for reducing MOCS data are also discussed. Author

N74-11291# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Forschungslab.

TECHNOLOGY OF LARGE SUPERCONDUCTING MAGNETS FOR HIGH ENERGY PHYSICS [TECHNOLOGIE SUPRALEITENDER GROSSMAGNETE FUER DIE HOCHENERGIEPHYSIK]

Cord Albrecht, Dieter Berger, Holger Franksen, Willi Fuchs, Manfred Hollfelder, Helmut Kuckuck, Dieter Kullmann, Richard Georg Maier, Claus-Peter Parsch, Bernd Streibl et al Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 140 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-73-04) Avail: NTIS HC $9.00; ALDI, Munich 29 DM

Technological fundamentals were developed for the construction of reliable, optimally designed superconducting magnets for high energy physics. The low temperature properties of the construction materials were determined, the conductors available commercially were improved, and test coils and magnet prototypes for the testing of winding techniques constructed. Computer programs were compiled in order to calculate all important data. The development, testing, and improvement of ancillary equipment, such as power supply units, magnet monitoring device, and safety systems, were carried out. ESRO

N74-11292# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

STRUCTURE AND MAINTENANCE OF THE DC EMF REFERENCE AT THE CALIBRATION LABORATORY [CONSTITUTION ET CONSERVATION DE LA REFERENCE DE DIFFERENCE DE POTENTIEL EN COURANT CONTINU DU LABORATOIRE D'ETALONNAGE]

28 May 1973 24 p In FRENCH

(LRBA-E-520-PV-13/SIE) Avail: NTIS HC $3.25

EMF standards using Western saturated electrolytic cells and Zener diodes are described. The problems inherent in Weston type saturated cells are discussed and the double chamber thermostat and temperature control is described. The intercalibration with the National EMF Standard is made by physical displacement of the secondary, Zener diode type, standard. Procedures adopted are detailed. The origin of uncertainties on primary standard EMF values and long term stability are discussed together with secondary standard control methods. Error analysis is detailed and three data processing methods are discussed. The long term influence of perturbations can therefore be studied and the consequences of these facts are drawn. The final result is that the total uncertainly on the primary standard is 4 microvolt. ESRO

N74-11293# Bonn Univ. (West Germany). Inst. Fuer Physik.

A DOUBLY FOCUSING MAGNETIC MASS SPECTROMETER WITH HELIUM COOLED ION SOURCE FOR MEASURING LOWER THERMOSPHERE NEUTRAL GAS DENSITY AND COMPOSITION [EIN DOPPEL-FOKUSSIERENDES MAGNETISCHES MASSENSPEKTROMETER MIT HELIUMGEKUEHLTER IONENQUELLE ZUR MESSUNG DER NEUTRALGASDICHTE UND -ZUSAMMENSETZUNG IN DER UNTEREN THERMOSPHAERE]

Helge Trinks and Thomas Hellenbroich Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1973 37 p refs In GERMAN; ENGLISH summary

(Contract WRK-227)

(BMFT-FBW-73-15) Avail: NTIS HC $4.00; ZLDI, Munich 7,35 DM

The design and performance of a magnetic mass spectrometer for investigation of the upper atmosphere are described. The instrument uses a helium cooled ion source and is carried by a sounding rocket. Diagrams are included to illustrate the systems of the instrument. The typical atmospheric constituents measured by the instrument are identified. Author (ESRO)

N74-11294# Siemens-Werke, Berlin (Germany). Produktbereich Elektronenmikroskope.

IMPROVEMENT OF THE RESOLUTION OF ELECTRON MICROSCOPES [STEIGERUNG DES AUFLOESUNGSVERMOEGENS VON ELEKTRONENMIKROSKOPEN]

Friedrich Thon and Dieter-Willasch Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1973 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-73-10) Avail: NTIS HC $3.50; ZLDI, Munich 5,90 DM

Several techniques, likely to improve the resolution of electron microscopes were investigated. These were the special apertures, phase plates, and light optical reconstruction to achieve a better phase contrast transfer function. An improved objective lens, optimal operating conditions for the electron gun, and means to preserve the object from contamination were also developed. Author (ESRO)

N74-11295# Army Electronics Command, Fort Monmouth, N.J.

DESIGN CONSIDERATIONS FOR THE CALCULATOR, ALTITUDE ML-646 (XE-1/UM)

Thomas J. Richter Aug. 1973 37 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-766699; ECOM-5504) Avail: NTIS CSCL 04/2

The purpose of this effort was to investigate the parameters that would affect the design of a non-electronic calculator intended for emergency use in the Automatic Atmospheric Sounding Set AN/TMQ-19. The designed calculator, ML-646(XE-1)/UM, is used to compute meteorological balloon altitude; it is the result of trade-offs involving basic measurement accuracies of the ground tracking system, AN/TMQ-19, curvature of the earth corrections, geopotential altitude above surface, refractivity, and pitch and roll of the ground tracking system. Author (GRA)

N74-11296# General Electric Co., Schenectady, N.Y. Microwave Tube Operation.

HIGH SENSITIVITY 1000F GAS MULTIPLICATION UV FLAME DETECTOR FOR AIRCRAFT Final Technical Report, 3 Apr. 1972 - 30 Jun. 1973

Ralph J. Bondley 30 Jun. 1973 80 p refs

(Contract F33615-72-C-1269)

(AD-766960; AFAPL-TR-73-62) Avail: NTIS CSCL 14/2

The program was undertaken to design and develop an ultraviolet sensitive Geiger-Mueller type sensor to be used as a flame detector in aircraft engine compartments. Major objectives of the program include low operating voltage, solar blindness, fast response or counting characteristics, and operation at the high temperatures encountered in engine compartments. The design emphasis was directed toward meeting the requirements of flight qualified hardware. Selection of sensor materials to withstand the temperature environment, and development of processing techniques for assembling these materials into UV sensors constitutes a major part of this program. Spectral response characteristics, electrical characteristics of the detector, and design details of a side-mounted housing are included in this report. Author (GRA)

N74-11297# ARO, Inc., Arnold Air Force Station, Tenn.

FIBER OPTICS PARTICLE-SIZING SYSTEM Final Report, Jul. 1971 - Jun. 1972

H. T. Bentley AEDC Sep. 1973 90 p refs

(AD-766647; ARO-OMD-TR-73-48; AEDC-TR-73-111) Avail: NTIS CSCL 20/4

A fiber optics particle-sizing system is discussed with respect to theory of operation and data acquisition and reduction techniques. The system uses a shadow-graphic technique to determine the dimensions and numbers of particles moving in a flow field. The system is digital in nature. Particles pass through a collimated laser beam and are imaged onto a linear array by a coaxial lens. The array is composed of the exposed ends of a fiber optics bundle which serves as a link between the array plane and the sensing photo-detector modules. Being an imaging device, it can measure a wide range of particle sizes through the proper selection of optics. Sizes ranging from 2 to 1500 micrometers have been measured in the course of this project. Comparisons of holographic data of a liquid rocket injector and of water spray nozzles are made with the fiber optics system. Author (GRA)

N74-11298# General Applied Science Labs., Inc., Westbury, N.Y.

STUDY OF MOIRE MEASURING TECHNIQUES FOR WIND TUNNEL MODEL DEFORMATION Final Report

Manlio Abele, Charles Roger, and Ernest Sanlorenzo Arnold AF Station, Tenn. AEDC Sep. 1973 71 p refs

(Contract F40600-72-C-0009)

(AD-766892; AEDC-TR-73-154) Avail: NTIS CSCL 14/2
An analytical and experimental study has been conducted to determine the feasibility of using Moire techniques for the accurate measurement of model distortions expected to be encountered in the HIRT Facility. A comprehensive study of the basic characteristics of Moire techniques has been carried out to determine the best approach which could both satisfy the constraints imposed by the size and configuration of the test section, and provide the necessary accuracy in the measurement of the local distortion. The results of the study suggest the selection of a measuring technique where the grating is an integral part of the surface of the test model. A Moire is formed by the superimposition of two images of the grating obtained in the undistorted and distorted condition of the test model. A null method of analyzing the Moire pattern allows the accurate measurement of the local distortion. (Modified author abstract)
GRA

N74-11299# Systems Science and Software, La Jolla, Calif.
IEMP (INTERNAL ELECTROMAGNETIC PULSE) SENSOR CALIBRATION METHOD
Daniel C. Osborn and Brian S. Flanagan Aug. 1973 23 p refs
(Contract DASA01-70-C-0156; DNA Proj. NWET-J29JAXB)
(AD-766505; SSS-R-73-1673; DNA-3125T) Avail: NTIS CSCL 14/2
The design, fabrication and capabilities of an 80-cm-diameter, several nanosecond rise time coaxial transmission line section with air dielectric is described. The line section was used for test and calibration of transient electromagnetic field sensors. The high frequency limitations of the line are discussed and several examples of measurements of the internal fields are given.
Author (GRA)

N74-11015 Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany).
SOME EXAMPLES OF QUANTITATIVE PICTURE PROCESSING FOR PHYSICAL, BIOLOGICAL, AND MEDICAL INTERROGATORIES [EINIGE BEISPIELE DER QUANTITATIVEN BILDVERARBEITUNG BEI PHYSIKALISCHEN, BIOLOGISCHEN UND MEDIZINISCHEN FRAGESTELLUNGEN]
W. Abmayr *In* DFVLR Picture Process. and Interactive Systems, Pt. 1 2-Jan. 1973 p 116-134 refs In GERMAN (For availability see N74-11010 02-07)

N74-11087 Joint Publications Research Service, Arlington, Va.
THE RIFMA LUNAR AUTOMATIC SPECTROMETRIC APPARATUS
G. Ye. Kocharov, N. F. Borodulin, S. V. Viktorov, O. M. Voropayev, A. Yu. Dzevanovskaya, O. G. Ivanov, G. V. Kiryan, V. V. Petrov, and V. A. Sakulskiy *In its* Lunokhod-1:- Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 136-146 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" - Moscow, - Nauka Publishers, 1971 (For availability see N74-11078 02-11)

N74-11226 National Ocean Survey, Rockville, Md. Meteorology Div.
STANDARDS AND TECHNIQUES TO QUALIFY OCEANOGRAPHIC INSTRUMENT MEASUREMENTS
R. J. Farland *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 82-95 refs (For availability see N74-11219 02-13)

N74-11230 Hokushin Electric Works Ltd., Tokyo (Japan).
MARINE DATA LOGGER FOR THE JAPANESE OCEANOGRAPHICAL SURVEY SHIP 'AKASHI'
S. Teramoto *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 126-133 (For availability see N74-11219 02-13)

N74-11234 Meteorological Office (Gt. Brit.).
LOW-POWER HUMIDITY SENSOR FOR UNATTENDED USE ON BUOYS
C. K. Folland *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 186-198 refs (For availability see N74-11219 02-13)

N74-11235 Meteorological Office (Gt. Brit.).
OFFSHORE TELEMETERING BUOY FOR REAL-TIME MONITORING OF SENSOR PERFORMANCE
M. J. Blackwell and K. J. T. Sands *In* WMO Means of Acquisition and Commun. of Ocean Data; Vol. 2 1973 p 199-201 (For availability see N74-11219 02-13)

N74-11244 Tsurumi Precision Instruments Co. Ltd., Yokohama (Japan).
SUB-SURFACE TEMPERATURE OBSERVATION BY REVERSING THERMOMETER, BT, XBT AND STD
H. Iwamima and M. Sekimoto *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 283-289 (For availability see N74-11219 02-13)

N74-11250 World Meteorological Organization, Geneva (Switzerland).
TEMPERATURE AND PRESSURE TRANSDUCERS FOR MOORED AND DRIFTING BUOYS
M. W. Shedlov *In its* Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 354-364 (For availability see N74-11219 02-13)

N74-11254 Ministry of Defence, London (England). Meteorology and Oceanographic Services.
ON THE MEASURING OF SEA SURFACE TEMPERATURE
R. R. Fotheringham *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 396-409 (For availability see N74-11219 02-13)

N74-11255 Maritime Weather Office, Cape Town (South Africa).
SEA-SURFACE TEMPERATURE BY DIRECT SAMPLING
A. B. Crawford *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 410-424 (For availability see N74-11219 02-13)

N74-11501 Gulf Radiation Technology, San Diego, Calif.
REVIEW OF FAST NEUTRON SPECTRUM MEASUREMENTS
C. A. Preskitt, B. K. Malaviya (Rensselaer Polytechnic Inst.), and E. F. Bennett (ANL) *In* AEC Natl. Topical Meeting of New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 943-958 refs (For availability see N74-11480 02-22)

N74-11502 Gulf Radiation Technology, San Diego, Calif.
PROTON-RECOIL PROPORTIONAL COUNTER SPECTROMETRY FOR REACTOR SPECTRUM MEASUREMENTS
V. V. Verbinski, J. C. Young, J. M. Neill, R. Gionvannini, and D. H. Houston *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 959-972 refs (For availability see N74-11480 02-22)
(Contract AT(04-3)-167)

N74-11612* Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
A DIRECTIONAL LOW ENERGY GAMMA-RAY DETECTOR
G. Morfill and G. F. Pieper *In* NASA. Goddard Space Flight Center Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 28 p refs (For availability see N74-11609 02-29)
CSCL 14B

N74-11613* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANISOTROPIC DETECTOR SYSTEM FOR THE MEASUREMENT OF GAMMA-RAY SOURCE POSITION
J. I. Trombka, E. L. Eller, J. I. Vette, R. L. Schmadebeck, and F. W. Stecker *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 10 p refs (For availability see N74-11609 02-29)
CSCL 14B

N74-11668* General Electric Co., Philadelphia, Pa. Space Div.

OSO-7 SPECTROHELIOGRAPH MECHANISMS
Donald N. Matteo *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 1-13 (For availability see N74-11667 02-31)
CSCL 22B

N74-11685* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID-DETECTOR DEPLOYMENT AND PRESSURIZATION SYSTEMS
H. C. Halliday *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 229-235 (For availability see N74-11667 02-31)
CSCL 22B

N74-11687* Martin Marietta Aerospace, Orlando, Fla.
THE VIKING SURFACE SAMPLER
Robert B. Seger and Vernon P. Gillespie (NASA. Langley Res. Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 245-255 (For availability see N74-11667 02-31)
CSCL 22B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-11300* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR WELDING BLADES TO ROTORS Patent
Kenneth H. Holko and Thomas J. Moore, inventors (to NASA) Issued 6 Nov. 1973 5 p Filed 24 Apr. 1972 Supersedes N72-25479 (10 - 16, p 2162)
(NASA-Case-LEW-10533-2; US-Patent-3,770,933; US-Patent-Appl-SN-247055; US-Patent-Class-219-107; US-Patent-Class-219-101; US-Patent-Class-219-78; US-Patent-Class-29-497.5) Avail: US Patent Office CSCL 13H

Using magnetic force upset welding to form T-joints between dissimilar thickness parts. This type of resistance welding is used to join compressor and turbine parts thereby reducing the weight and cost of a jet engine.
Official Gazette of the U.S. Patent Office

N74-11301* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF MAKING PRESSURE TIGHT SEAL FOR SUPER ALLOY Patent
Robert E. Little, Inventor (to NASA) Issued 6 Nov. 1973 5 p Filed 12 Jan. 1972 Supersedes N72-21471 (10 - 12, p 1616)
(NASA-Case-LAR-10170-1; US-Patent-3,769,689; US-Patent-Appl-SN-217213; US-Patent-Class-29-498; US-Patent-Class-29-460; US-Patent-Class-29-503; US-Patent-Class-29-527.2; US-Patent-Class-117-105.2) Avail: US Patent Office CSCL 11A

A procedure for forming a pressure tight seal along two edges of super alloy sheets is presented. The procedure consists of flame spraying a powdered aluminum-nickel composition on the joint. The use of frozen carbon dioxide and carbon dioxide gas to maintain a low temperature environment during the flame spraying is described. P.N.F.

N74-11302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZATION OF SELF-ACTING HERRINGBONE JOURNAL BEARING FOR MAXIMUM STABILITY
David P. Fleming and Bernard J. Hamrock [1973] 14 p refs Proposed for presentation at the 6th Intern. Gas Bearing Symp., Southampton, England, 26-29 Mar. 1974
(NASA-TM-X-71475; E-7793) Avail: NTIS HC $3.00 CSCL 13I

Groove parameters were determined to maximize the stability of herringbone grooved journal bearings. Parameters optimized were groove depth, width, length, and angle. Optimization was performed using a small eccentricity, infinite groove analysis in conjunction with: (1) a previously developed Newton-Raphson procedure for bearings with the smooth member rotating or with the grooved member rotating at low compressibility numbers, and (2) a newly-developed vector technique for bearings with the grooved member rotating at high compressibility numbers. The design curves enable one to choose the optimum bearing for a wide range of operating conditions. These include: (1) compressibility numbers from 0 (incompressible) to 80, (2) length to diameter ratios from 1/4 to 2, and (3) smooth or grooved member rotating. Compared to bearings optimized to maximize load capacity, bearings optimized for stability: (1) allow a thousandfold increase in bearing-supported mass in some cases before onset of instability (the most dramatic increase are for bearings with small L/D operating at high compressibility numbers), and (2) lose no more than 77-percent of their load capacity in any case studied. Stability is much greater when the grooved member rotates. Author

N74-11303*# Avco Corp., Lowell, Mass.
SINK-FLOAT FERROFLUID SEPARATOR APPLICABLE TO FULL SCALE NONFERROUS SCRAP SEPARATION Final Report, 28 Jun. 1972 - 28 Jun. 1973
[1973] 130 p refs
(Contract NA61-11793)
(NASA-CR-132318) Avail: NTIS HC $8.50 CSCL 13H

Design and performance of a ferrofluid levitation separator for recovering nonferrous metals from shredded automobiles are reported. The scrap separator uses an electromagnet to generate a region of constant density within a pool of ferrofluid held between the magnetic poles; a saturated kerosene base ferrofluid as able to float all common industrial metals of interest. Conveyors move the scrap into the ferrofluid for separation according to density. Results of scrap mixture separation studies establish the technical feasibility of relatively pure aluminum alloy and zinc alloy fractions from shredded automobile scrap by this ferrofluid levitation process. Economic projections indicate profitable operation for shredders handling more than 300 cars per day. G.G.

N74-11304*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEST CHARACTERISTICS OF A WELDED ROTOR IN A 36,000-RPM LUNDELL ALTERNATOR
Stacy Lumannick, David W. Medwid, and George Tulisiak Washington Nov. 1973 15 p refs
(NASA-TM-X-2944; E-7535) Avail: NTIS HC $2.75 CSCL 10A

Two four-pole Lundell-type rotors consisting of magnetic and nonmagnetic materials were fabricated by weld-depositing Inconel 625 between two sections of AISI 4617 steel. The rotors had a major diameter of 8.28 cm (3.26 in.). Saturation curves for load and no-load conditions with one of the rotors installed in a 1200-Hz Brayton-cycle research alternator are presented. The other identical rotor was spin-tested to a speed of 63,000 rmp, which was equal to 175 percent of the rated speed. Author

N74-11305*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF VARIOUS FIXED-GEOMETRY WATER-LUBRICATED HYDRODYNAMIC JOURNAL BEARINGS FOR MAXIMUM STABILITY
Fredrick T. Schuller Washington 1973 101 p refs
(NASA-SP-333; LC-73-600235) Avail: NTIS HC $4.25 CSCL 13I

This publication is the result of over 260 fractional-frequency-whirl stability tests on a variety of fixed-geometry journal bearings. It is intended principally as a guide in the selection and design of antiwhirl bearings that must operate at high speeds and low loads in low-viscosity fluids such as water or liquid metals. However, the various fixed-geometry configurations can be employed as well in applications where other lubricants, such as oil, are used and fractional-frequency whirl is a problem. The important parameters that effect stability

are discussed for each bearing type, and design curves to facilitate the design of optimum-geometry bearings are included. A comparison of the stability of the different bearing configurations tested is also given. Author

N74-11306*# Goodrich (B. F.) Co., Troy, Ohio. Aerospace and Defense Products.
ENGINEERING REPORT. PART 1: NASA WHEEL AIR SEAL DEVELOPMENT FOR SPACE SHUTTLE TYPE ENVIRONMENTAL REQUIREMENTS
23 Jan. 1973 43 p refs
(Contract NAS9-12049)
(NASA-CR-134128; Rept-4239-Pt-1) Avail: NTIS HC $4.25 CSCL 11A

The sealing techniques are studied for existing aircraft wheel-tire designs to meet the hard vacuum .00001 torr and cold temperature -65 F requirements of space travel. The investigation covers the use of existing wheel seal designs. Author

N74-11307# General Dynamics/Fort Worth, Tex.
MANUFACTURING METHODS FOR MACHINING PROCESSES FOR HIGH MODULUS COMPOSITE MATERIALS. VOLUME 1: COMPOSITE MACHINING HANDBOOK - BORON Final Report
F. Handley and J. T. Hardage Wright-Patterson AFB, Ohio AFML 31 May 1973 97 p
(Contract F33615-73-C-1504-16; AF Proj. 707-9)
(AD-766332; FMR-7-2117; AFML-TR-73-124-Vol-1) Avail: NTIS CSCL 13/8

The report is a boron composites machining handbook for use by engineering and production personnel concerned with fabrication of advanced composite structures. The handbook recommends specific cutting tools and machine tool setting for drilling, reaming, countersinking, milling, routing, and sawing boron-epoxy, boron-aluminum, and boron-titanium laminate. Author (GRA)

N74-11308# Southwest Research Inst., San Antonio, Tex.
REFERENCE OIL C STATUS REPORT, 1972 Technical Report, 1 Jan. 1972 - 1 Jan. 1973
Burl B. Baber Aug. 1973 56 p refs
(Contract F33615-72-C-1097; AF Proj. 3048)
(AD-766519; SwRI-rs-602; AFAPL-TR-73-22) Avail: NTIS CSCL 11/8

A summary of the gear load-carrying capacity of Reference Oil C, determined by from three to eight cooperating laboratories using Ryder gear machines, WADD gear machines, and AFB gear machines, is presented. Based upon 1,232 determinations obtained during a 6-yr period using the three different machine types, the overall mean-load-carrying capacity for Reference Oil C is shown to be 2,963 lb/inch. A possible difference, at the 95-percent confidence level, in the load-carrying capacity obtained using test gears with different gear letter prefixes is indicated. This possible difference in test gears, however, is overshadowed by the wide spread, up to 564 lb/in., in the mean load-carrying capacities obtained by the different laboratories. Inspection data for Reference Oil C, recorded semiannually for a period of over 6 yr, do not indicate any appreciable change in viscosity, neutralization number, API gravity, saponification number, water content, trace sediment, or contamination. Author (GRA)

N74-11309# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.
AN EXPERIMENTAL STUDY OF THE VISCOPLASTIC BENDING OF COPPER-NICKEL AND STEEL TUBING Progress Report, Aug. 1972 - Jun. 1973
Thomas M. Frick and V. H. Neubert Jun. 1973 74 p refs
(Contract N00014-67-A-0385-0010)
(AD-766836; PR-4) Avail: NTIS CSCL 13/11

The results of shock machine tests of 70/30 copper-nickel and 1020 steel tubing are presented. The copper-nickel tubing had a 0.675 in. O.D. and the steel 0.625 in. O.D. The specimens were arranged as hinged-hinged beams carrying a heavy central mass. The acceleration of the mass and the strain on the tubing were measured and the resulting experimental moment and curvature calculated as a function of time. Static tests were also conducted. The constants in proposed moment-curvature relationships were deduced and discussed. Author (GRA)

N74-11310# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
DEVELOPMENT OF COMPOSITE JOINTS IN GRAPHITE/EPOXY LAMINATES OF MODULITE 5206-II Progress Report
Warren T. Kelly 22 Jun. 1973 39 p refs
(AD-766788; NADC-73006-30) Avail: NTIS CSCL 13/5

The report covers the investigation of Modulite 5206-II graphite composite in joints. Double lap joints evaluated in 0 degrees and 42 degrees direction to surface fiber had similar strengths. Author (GRA)

N74-11311# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
THE ANALYSIS AND DESIGN OF COMPOSITE MATERIAL BONDED JOINTS UNDER STATIC AND FATIGUE LOADINGS
W. James Renton and Jack R. Vinson Aug. 1973 446 p refs
(Grant AF-AFOSR-1760-69; AF Proj. 9782)
(AD-766932; MAE-TR-169; AFOSR-73-1627TR) Avail: NTIS CSCL 13/5

Extensive research was conducted providing analysis methods and design methodology for bonded joints in structures of laminated composite materials under static and fatigue loads. An analytical closed form solution was developed for stresses and deformations in the adhesive joint and the adherends, including transverse shear deformations and normal strain, adherend anisotrophy, and adhesive properties. A digital program provided rapid design and analysis; an inclusive parameter study provides trends and methodology. Static tests were developed providing shear and extensional stiffnesses and ultimate stresses of the adhesive in the joint configurations. Fatigue tests were conducted for various geometries, loadings, and adherend materials. Author (GRA)

N74-11312# General Electric Co., Bay Saint Louis, Miss.
DANGEROUS MATERIALS COMPATIBILITY STUDY Final Report
Wayne R. Wilcox 16 Feb. 1973 136 p refs
(Contract F33601-71-C-0808)
(AD-766947; GE-HERE-FR-040) Avail: NTIS CSCL 13/12

The objective of the study was to critically review the hazards classification and packaging requirements of the more than 1300 dangerous materials regulated for shipment by military air. Dangerous materials are those posing dangers to life and property and include those classified as explosive, flammable, corrosive, oxidizing, toxic and etiologic. The study is divided into three separate phases. In Phase I, Conditions of Air Shipment, the environmental conditions of air shipment are used to establish normal, maximum probable, and maximum credible conditions. Comparison is made between the environment of air shipment and that of other modes of transportation. In Phase II, Compatibility Determinations procedures are developed to determine the chemical reactivity hazards resulting from binary mixtures of specific dangerous materials. Each of the more than 1300 materials is classified by one or more of the 93 functional and reactivity groups defined in the study. In Phase III, Container Development, the packaging prescribed for the shipment of dangerous materials by military air is critically reviewed. (Modified author abstract) GRA

N74-11669* European Space Technology Center, Noordwijk (Netherlands).
DEVELOPMENT OF AND DYNAMIC STUDIES CONCERNING A CABLE BOOM SYSTEM PROTOTYPE
G. Bring, G. Schmidt (Domier-Werke G.m.b.H.), and D. Wyn-Roberts (British Aircraft Corp., Bristol) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 15-23
(For availability see N74-11667 02-31)
CSCL 22B

N74-11672* European Space Research and Technology Center, Noordwijk (Netherlands).
CURRENT EUROPEAN DEVELOPMENTS IN SOLAR

PADDLE DRIVES
R. H. Bentall *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 49-58 refs (For availability see N74-11667 02-31)
CSCL 22B

N74-11673* Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
TELESCOPIC BOOMS FOR THE HAWKEYE SPACECRAFT
Roger D. Anderson *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 59-68 ref (For availability see N74-11667 02-31)
CSCL 22B

N74-11674* General Electric Co., Philadelphia, Pa.
THE DEVELOPMENT AND TEST OF A LONG-LIFE, HIGH RELIABILITY SOLAR ARRAY DRIVE ACTUATOR
Don. L. Kirkpatrick *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 69-83 (For availability see N74-11667 02-31)
CSCL 22B

N74-11675* Reusser (Peter) A.G., Zurich (Switzerland).
HIGH PERFORMING ACTUATION SYSTEM FOR USE WITH A LOUVER ARRAY FOR SATELLITE THERMAL CONTROL
Peter U. Reusser and Jan A. F. Coebergh *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 85-96 refs (For availability see N74-11667 02-31)
CSCL 22B

N74-11676* Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF THE ELEVATION DRIVE ASSEMBLY FOR ORBITING SOLAR OBSERVATORY I (EYE)
W. F. Sharpe, M. C. Olson, and B. W. Ward (NASA. Goddard Space Flight Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 97-108 (For availability see N74-11667 02-31)
CSCL 22B

N74-11677* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW APPROACH TO LONG-LIFE NONCONTACTING ELECTROMECHANICAL DEVICES
Edward J. Devine *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 109-116 (For availability see N74-11667 02-31)
CSCL 22B

N74-11678* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF THE TECHNOLOGY OF NONCONTACTING SYSTEMS
Philip A. Studer *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 117-130 refs (For availability see N74-11667 02-31)
CSCL 22B

N74-11679* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND DEVELOPMENT OF A MOMENTUM WHEEL WITH MAGNETIC BEARINGS
Leo J. Veillette *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 131-143 (For availability see N74-11667 02-31)
CSCL 22B

N74-11684* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ROCKET ENGINE BIPROPELLANT VALVE PROBLEMS AND CURRENT EFFORTS
Joseph Fries *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 213-228 (For availability see N74-11667 02-31)
CSCL 22B

N74-11686* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
CONTROL VALVE: HOT GAS FAST RESPONSE
J. T. Hollis, A. B. Killabrew, and J. M. Smith *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 237-244 (For availability see N74-11667 02-31)
CSCL 22B

N74-11688* Martin Marietta Aerospace, Orlando, Fla.
VIKING LANDER ANTENNA DEPLOYMENT MECHANISM
Kenneth H. Hopper and Dean S. Monitor *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 257-269 (For availability see N74-11667 02-31)
CSCL 22B

N74-11693* Hughes Aircraft Co., Culver City, Calif.
POLYURETHANE RETAINERS FOR BALL BEARINGS
R. I. Christy *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 317-327 ref (For availability see N74-11667 02-31)
CSCL 13I

N74-11694* Spar Aerospace Products, Ltd., Toronto (Ontario).
MULTI-POINT RELEASE MECHANISM
E. Groskopfs *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 329-334 (For availability see N74-11667 02-31)
CSCL 13I

N74-11695* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING ORBITER 1975 ARTICULATION CONTROL ACTUATORS
G. S. Perkins *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 335-350 (For availability see N74-11667 02-31)
(Contract NAS7-100)
CSCL 22B

N74-11735* Houston Univ., Tex.
IMPLEMENTATION OF A HYDROGEN ENERGY CARRIER SYSTEM
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 147-151 (For availability see N74-11728 02-33)
CSCL 13H

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-11313* Smithsonian Astrophysical Observatory, Cambridge, Mass.
TUNABLE CAVITY RESONATOR WITH RAMP SHAPED SUPPORTS Patent
Robert F. C. Vessot, Thomas E. Hoffman, and Martin W. Levine, inventors (to NASA) Issued 6 Nov. 1973 5 p Filed 20 Mar. 1972 Supersedes N72-25491 (10 - 16, p 2164) Sponsored by NASA
(NASA-Case-HQN-10790-1; US-Patent-3,771,074; US-Patent-Appl-SN-235962; US-Patent-Class-333-83R; US-Patent-Class-333-97R) Avail: US Patent Office CSCL 20E

A cavity for a hydrogen maser is described consisting of three parts which provide highly stable mechanical and thermal expansion characteristics for the cavity and ease of tuning. The three parts which are made of a glass ceramic material having a very small thermal expansion coefficient (1) a top plate, (2) a cylinder with three interrupted helical ramps at its bottom, and (3) a base which includes a bottom plate and three ramp lugs on which the helical ramps of the cylinder rest when the cylinder is placed on the base with the bottom plate in the cylinder. Cavity tuning is achieved by rotating the cylinder and thereby raising or lowering it on the base, which results in changing the cylinder volume by changing the distance between the bottom and top plates. Offical Gazette of the U.S. Patent Office

N74-11314 Washington Univ., Seattle.
THEORETICAL ANALYSIS OF 10.6 MICRON WAVELENGTH CO2 LASER INDUCED BREAKDOWN IN CLEAR AIR AND WITH WATER DROPLETS Ph.D. Thesis
Dennis Eric Maiden 1972 138 p
Avail: Univ. Microfilms Order No. 73-13856

The breakdown of 10.6 micron wavelength CO2 laser radiation

in air containing water droplets is analyzed. The method is a synthesis of the average electron method which takes explicit account of the basic electron-particle collision processes, and the phenomenological theory that is implicit in the use of a single universal relationship between the effective field and the net ionization frequency. The average electron collision frequency in air is independent of electron energy. Clear air breakdown as a function of pressure, temperature, diffusion distance, and pulse width is derived and compared accurately with existing equilibrium and kinetic theories for STP air. A proper treatment of breakdown of air containing water droplets is determined by a numerical solution of the non-equilibrium fluid mechanical equations coupled with the electron continuity and radiative transport equations. Dissert. Abstr.

N74-11315# Institut Franco-Allemand de Recherches, St. Louis (France).
HIGH SPEED MICROHOLOGRAPHY. EXPERIMENTAL STUDY [MICROHOLOGRAPHIE ULTRA-RAPIDE. ETUDE EXPERIMENTALE]
F. Albe 3 Jan. 1973 50 p refs In FRENCH
(Contract DRME-72/329)
(ISL-4/73) Avail: NTIS HC $4.50

Holograms of opaque or transparent, motionless or hypervelocity (200 m/sec) microparticles were recorded using a monomode ruby laser. Various mountings are described including the reflection mounting, the Gabor mounting, the light transmission off-axis mounting, and the diffuse light off-axis mounting. The Ne-He laser restituted images (1 magnification factor) were enhanced using an objective-lens coupled to a television camera in closed circuit. Some conclusions on hologram types to be used for the observation of hypervelocity microparticles following their nature and their dimensions are deduced. ESRO

N74-11316# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF A PHOTODICHROIC MATERIAL FOR HOLOGRAPHIC STORAGE AND RECOVERY Annual Technical Report, Jul. 1972 - Aug. 1973
Matt Lehmann Aug. 1973 33 p refs
(Contract N00014-72-C-0260; SRL Proj. 1777)
(AD-766499) Avail: NTIS CSCL 20/6

Sodium fluoride (NaF), a space-centered cubic alkali halide crystal, when irradiated by high-energy electrons, X-rays, or ions forms F and M center absorption bands that can be modified by illumination with spatially modulated, polarized UV light at room temperature. The dipole moment formed by the M center provides a very-high-resolution polarizable absorption that can be read with polarized light and is therefore capable of information storage and recovery by holographic methods. The material is capable of write, erase, and read cycling with good reproducibility. Determination that there is a refractive-index shift at the base of the absoprtion zones suggests that phase holography is possible in this material, with attendant improved diffraction efficiencies. Modification of color-center formation by selected ion implantation indicates that higher sensitivity and diffraction efficiencies are possible without sacrificing the desirable properties of the basic material. Fourier-transform holograms as well as multiple gratings have been recorded and recovered. This material has satsifactorily demonstrated that it is a prime candidate for holographic storage where real-time write, read, and erase are specified requirements. Author (GRA)

N74-11317# Army Electronics Command, Fort Monmouth, N.J.
A PROPOSED VERSATILE PHOTON COUNTER SYSTEM FOR LASER RADAR
Gerald T. Wade, Teddy L. Barber, and Robert Armstrong Sep. 1973 27 p refs Prepared by Atmospheric Sci. Lab.
(DA Proj. 1T0-61102-B-53A)
(AD-766678; ECOM-5508) Avail: NTIS CSCL 17/8

A high-speed, multi-channel photon counting system has been proposed for use with a variety of laser radar (lidar) experiments. It utilizes two solid state buffer memories to replace the large array of counters normally associated with such a system and a minicomputer to handle data manipulation and display. The speed and versatility make the system a reasonable alternative to systems presently in use. System features include a 250 MHz photon counting rate, 100 nanosecond minimum sample interval, up to 512 channel data accumulation with sub-nanosecond switching times between channels, and a maximum laser transmitter repetition rate of 10 KHz. This system offers several advantages over presently available systems, such as allowing the higher laser repetition rates needed to monitor a rapidly fluctuating atmosphere without sacrificing spatial resolution or the total number of data channels, and enabling real-time modification of the system operating parameters as a function of incoming data. This paper describes the parameters influencing the design of such a system. Author (GRA)

N74-11318# Hughes Research Labs., Malibu, Calif.
ADVANCED MODE CONTROL AND HIGH POWER OPTICS TECHNOLOGY. VOLUME 2: HALIDE WINDOW MATERIALS TECHNOLOGY Technical Report, 18 Oct. 1971 - 31 Oct. 1972
R. C. Pastor and M. Braustein Kirtland AFB, N. Mex. AFWL Jul. 1973 154 p refs
(Contract F29601-71-C-0108; ARPA Order 1256; AF Proj. 1256; AF-Proj. 317J)
(AD-766479; AFWL-TR-72-152-Vol-2) Avail: NTIS CSCL 20/5

The results reported here represent significant advances in the state of the art of high-power laser windows and coatings. An order-of-magnitude improvement was achieved in the material parameters of single crystal KCl over the values which characterized the best available materials at the beginning of the study. The RAP technique, involving processing under an atmosphere of He - CCl4, was used for window materials purification, crystal growth, and for surface layer exchange in KCl crystals. It led to the development of a one-step processing for KCl crystal growth, from powder to crystal, which minimizes the incorporation of OH(-) in the KCl crystals. Optical, mechanical, and surface stability evaluations of various fluoride and chloride crystals are also reported. The coating program goal, which was to achieve 0.1% or less absorption per coated window surface at 10.6 micrometers, has been demonstrated for some of the optical coatings prepared during the program. Theoretical designs and experimental results for coatings for alkali halides, zinc selenide, and cadmium telluride are presented with emphasis placed on coatings for KCl. (Modified author abstract) GRA

N74-11319# Aerospace Corp., El Segundo, Calif.
HF CHEMICAL LASING AT HIGHER VIBRATIONAL LEVELS Technical Report, May - Dec. 1972
S. W. Mayer, D. Taylor, and M. A. Kwok 1 Sep. 1973 18 p refs
(Contract F04701-73-C-0074)
(AD-766411; TR-0074(4270-10)-1; SAMSO-TR-73-264) Avail: NTIS CSCL 07/4

HF chemical lasing has been obtained from the P6(5) and P6(4) transitions as well as several P5 and P4 transitions of HF. Lasing from these high vibrational levels was produced by transverse, pulsed discharges in mixtures of HI He, and SF6 or SO2F2. The low bond energy of HI contributed to the doubling of the energy of laser pulses when substituted for H2. The HF laser frequencies were measured for other low bond energy sources of H atoms. GRA

N74-11320# Aerospace Corp., El Segundo, Calif.
HCl CHEMICAL LASING WITH HI AND CHLORO-COMPOUNDS Technical Report, Jul. - Nov. 1972
David Taylor and Stanley W. Mayer 28 Jun. 1973 20 p refs
(Contract F04701-73-C-0074)
(AD-766412; TR-0074(4270-10)-2; SAMSO-TR-73-266) Avail: NTIS CSCL 07/4

HCl chemical lasing has been obtained from chloro-compounds when HI was used as the source of H atoms. Lasing was produced from several P1, P2 and P3 and HCl transitions by transverse pulsed discharges in HI, He mixtures containing such chloro-compounds as CCl4, CHCl3, and several Freons. Both HCl and HF lasing were observed when (C2Cl2F4) was used. The measured wavelengths for this HCl laser corresponded to excellent atmospheric windows for transmitting infrared radiation. No HCl lasing was obtained when HBr, N2S, or H2 were substituted for HI. (Modified author abstract) GRA

N74-11321# Boeing Aerospace Co., Seattle, Wash.
AN INVESTIGATION OF LASER-SUPPORTED DETONATION WAVES Technical Report, 24 Feb. 1972 - 23 Mar. 1973
R. B. Hall, W. E. Maher, and P. S. P. Wei Jun. 1973 271 p refs
(Contract F29601-72-C-0064; ARPA Order 1256; AF Proj. 1256)
(AD-766766; D80-15336-1; AFWL-TR-73-28) Avail: NTIS CSCL 20/5

A pulsed 10.6 micron laser emitting 20 joules energy at a peak power of 3 megawatts has been used to study laser-supported detonation waves in air. The thresholds for igniting these absorption waves have been determined for various metals, plastics, and painted surfaces in air. It is found that the intensity thresholds vary from 6 x 10 to the 6th power watts/sq cm for painted surfaces to 4.5 x 10 to the 7th power watts/sq cm for silica at standard atmospheric pressure. Such a detonation wave is found to change features late in the laser pulse becoming a subsonic absorption wave with a long luminous column of plasma filling the laser beam. Time-resolved interferometry with an argon laser and interferograms with a pulsed ruby laser show the ignition, growth, and decay of both the detonation wave itself and of the radial shock waves which are produced. Spectroscopic studies have been made showing both time-integrated and time-resolved temperatures. These measurements indicate the radial and time-dependence of the shock waves on the target surface. Theoretical calculations of the propagation of subsonic laser-supported combustion waves have been performed using analytical techniques and approximations to thermodynamic and transport properties of air. (Modified author abstract) GRA

N74-11322# ILC Technology, Inc., Sunnyvale, Calif.
OPTICAL PUMPS FOR HOLMIUM LASERS Triannual Report No. 1, 1 Jul. - 31 Oct. 1972
Lowell D. Noble Jun. 1973 37 p refs
(Contract DAAB07-72-C-0274)
(AD-766775; R-ILC-73-7; ECOM-0274-1) Avail: NTIS CSCL 20/5

The overall objective of the program is to produce more efficient pulsed optical pumps for use with holmium-doped yttrium lithium fluoride laser materials (Ho:YLF). The absorption and excitation spectra of Ho:YLF laser material have been determined. Twenty-nine xenon lamps have been constructed and tested. The effect of varying the parameters of noble gas arc lamps on the fluorescent light output of Ho:YLF laser material is being studied. Preliminary in-laser lamp tests have been made at input energies between 9 joules and 23 joules. (Modified author abstract) GRA

N74-11323# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PHOTOGRAPHIC OBSERVATIONS OF CW Hf CHEMICAL LASER REACTING FLOW FIELD
Robert L. Varwig 15 Aug. 1973 39 p refs
(Contract F04701-73-C-0074)
(AD-766645; TR-0074(4240-10)-6; SAMSO-TR-73-297) Avail: NTIS CSCL 20/5

The luminosity of the reacting gas in the flow field of a chemical HF laser from a wedge-shaped three-component nozzle has been observed photographically. The effects of variations of ambient test-section pressure, secondary nozzle flows, and variations of H2 fuel mass flow rates were observed. In these photographs, the edge of the luminous layer is assumed to be a measure of the diffusion of H2 into the primary nozzle oxidizer flow. The presence of shock structure in the flow field is noted, and an attempt to account for this effect is included. Observations of both a linear and parabolic growth of the luminous layer were noted. The presence of a parabolic growth appeared to require both ambient pressure less than or equal to nozzle exit pressures and the absence of a significant base region.
Author (GRA)

N74-11324# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
STUDIES OF SENSITIZATION MECHANISMS AND ENERGY TRANSFER IN CRYSTALS OF MULTIPLY DOPED RARE EARTH IONS Final Report, 1 Apr. 1970 - 31 Mar. 1973
Evan P. Chicklis, Charles S. Naiman, and Isaac D. Abella Aug. 1973 38 p refs
(Contract F44620-70-C-0068; AF Proj. 9768)
(AD-766843; AFOSR-73-1588TR) Avail: NTIS CSCL 20/5

Previous publications and reports are supplemented by two contributions to the study of sensitization and energy transfer between rare earth ions in this final report. The first is a general and tutorial review of Cooperative Effects in Crystals. It stresses energy transfer and radiationless transitions. The second is an invited paper presented at the First European Electro optics Markets and Technology Conference, Geneva, Switzerland. It is A Review of Near IR Optically Pumped Solid State Lasers, high lighting the role the radiationless transitions and lattice properties play in creating such lasers. Author (GRA)

N74-11325# Aerospace Corp., El Segundo, Calif.
ZERO-POWER GAIN MEASUREMENTS IN A CW HF LASER USING A PULSED-PROBE LASER Technical Report, Mar. - Jun. 1971
Richard A. Chodzko, Donald J. Spencer, and Harold Mirels 20 Sep. 1973 28 p refs
(Contract F04701-73-C-0074)
(AD-766415; TR-0074(4534)-2; SAMSO-TR-73-287) Avail: NTIS CSCL 20/5

Zero-power gain measurements in a supersonic diffusion-type CW HF laser are made using a pulse HF probe laser. A peak zero-power gain of 10% cm is measured on a P2(3) vibrational-rotational transition and 7% cm on a P1(6) transition for flow rates corresponding to 1j8 kW of closed-cavity power. The measured streamwise gain distributions of the P2(5) and P1(6) transistions were compared with the theory of King, et al., and the values of the peak gain agreed to within 50%. The variation of zero-power gain with rotational quantum number J fits a simple rotational equilibrium model indicating increasing rotational temperatures with increasing distance x from the nozzle exit plane. The model also indicates a total inversion for x + or - 0.2 in. for the P2(J) transitions and a partial inversion further downstream. The results indicate large amplitudes (about 50%) temporal-gain fluctuations in the active medium and the measured gain in a time-averaged value. Author (GRA)

N74-11326# GTE Labs., Inc., Waltham, Mass.
HIGH ENERGY PULSED LIQUID LASER Semiannual Technical Summary Report, 1 Feb. - 31 Jul. 1973
H. Samelson, R. Kocher, and A. Lempicki 31 Aug. 1973 82 p refs
(Contract N00014-68-C-0110; ARPA Order 1806)
(AD-766812; TR-73-826.4) Avail: NTIS CSCL 20/5

Significant advances have been made in both the performance and understanding of liquid lasers. High average powers in excess of 400 watts at 5 pps have been obtained during the course of the work. Some scaling laws in terms of the relationship between active volume and power loading have emerged. Finally, a large body of information relating steady-state laser performance to imposed thermal gradients has been obtained, and a method has been devised for reducing the data so that the information it contains is readily displayed. In addition, a hydrodynamic model for the liquid in turbulent flow under various temperature differentials has been obtained. This model provides detailed information on the radial thermal gradient. Under the special condition of extrapolation to zero power input, the model can be related to the experiment and significant information on the nature and the effect of the thermal gradient on laser performance. The picture that emerges from this is then qualitatively extended to the case of high average power loading. (Modified author abstract) GRA

N74-11327# Aerospace Corp., El Segundo, Calif.
EFFICIENT PULSED CHEMICAL LASER
Steven N. Suchard, Alfred Chang, and James S. Whittier 15 Sep. 1973 15 p refs
(Contract F04701-73-C-0074)
(AD-766894; SAMSO-TR-73-294) Avail: NTIS CSCL 20/5

Output pulse observations are presented for a He-diluted CO2 laser pumped by vibrational-vibration (VV) energy transfer from vibrationally excited DF produced by the D2-F2 chain reaction. Flash photolysis of the F2 initiated the reaction. A 290-cc reaction chamber containing a 0.5-atm mixture with a

mole ratio D2:F2:CO2:He + or - 0.33:1.8:10 gave a single-pulse output energy of 2.8 J. Relative to the amount of D2 present in the reaction chamber, this corresponds to a chemical efficiency greater than 5%. Author (GRA)

N74-11328# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THERMOPHYSICAL AND OPTICAL EVALUATION OF HEAT PIPE COOLED LASER MIRRORS M.S. Thesis
David Raspet Jun. 1973 174 p refs
(AD-766883; GEP/PH/73-17) Avail: NTIS CSCL 20/5

A concept for cooling laser mirrors with the heat pipe process was evaluated with a 2-inch diameter copper mirror. The mirror was illuminated by a 67 watt/square centimeters incident beam from a 10 kilowatt carbon arc lamp. This beam provides 34.2 watts/squared centimeters to the water heat pipe. Reflecting surface temperature distributions were measured to assess heat pipe operation. Reflecting surface distortions were measured from the change in focal length. Despite a problem with obtaining good wetting of the copper capillary structure of the heat pipe by the water, the heat pipe demonstrated the ability to significantly reduce reflecting surface temperature gradients. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-11329 Case Western Reserve Univ., Cleveland, Ohio.
MECHANICAL PROPERTIES OF INTERSTITIAL ALLOYS OF NIOBIUM Ph.D. Thesis
Michael Gary Ulitchny 1972 232 p
Avail: Univ. Microfilms Order No. 73-6346

The phenomenon of alloy softening in interstitial alloys of bcc metals has been attributed to a reduction in the Peierls stress, an increase in moble dislocation density and to interactions of solute atoms. The present study was undertaken in an attempt to determine which of these possible causes actually accounts for alloy softening. Very high purity niobium (approaching one at.ppm residual interstitial) was prepared and used as the base material for a series of mechanical properties tests. Small additions of either oxygen or nitrogen hardened the high purity niobium over the temperature range from 77 to 500 K. The simultaneous addition of both nitrogen and oxygen in the composition range of 50 to 500 at.ppm of either or both interstitials caused alloy softening at all temperatures from 77 to 373 K. This softening is shown to result, almost exclusively, from a reduction of the thermally activatable part of the flow stress. Dissert. Abstr.

N74-11330 Maryland Univ., College Park.
PROPAGATION OF TENSILE AND FATIGUE CRACKS IN METAL FOILS Ph.D. Thesis
John Anthony Alic 1972 208 p
Avail: Univ. Microfilms Order No. 73-14110

Crack growth in foil specimens, mostly 1 mil thick, of aluminum, brass, cooper, and tantalum has been studied under monotonic tension and low cycle fatigue. Crack tip regions were observed by optical microscopy during testing. Following final fracture, the crack path and fracture surface were examined by scanning electron microscopy. Dynamic studies were also carried out within the scanning electron microscope. Both tensile and fatigue cracks were found to be typically preceded by a narrow necked region, or, alternatively, a group of course slip bands. Voids or holes extending through the thickness of the foil develop ahead of the crack, which extends as they enlarge and coalesce. As the voids nucleate and grow, the foil necks down to zero thickness along the path of the crack. Crack growth in both tension and fatigue results, therefore, from concentrated plastic strain. Because of irregularities in slip bands the plastic flow ahead of the crack tip is inhomogeneous to an extent that voids precede the crack. Dissert.Abstr.

N74-11331 Stanford Univ., Calif.
ANOMALOUS DIFFUSION COEFFICIENT EFFECTS AND THE SUBGRAIN SIZE EFFECT UPON HIGH TEMPERATURE CREEP OF METALS Ph.D. Thesis
Steven Lynn Robinson 1973 142 p
Avail: Univ. Microfilms Order No. 73-14966

The effects of anomalously rapid lattice self diffusion on high temperature creep and the effect of subgrains formed during high temperature creep of metals were studied. Creep studies performed on the anomalously diffusing metals provide a critical test of the belief that all high temperature creep is diffusion controlled. The subgrain size-applied stress relation was quantified for a number of metals. It is demonstrated that both steady state creep, and certain forms of transient creep behavior are described by the inclusion of the subgrain size into a steady state creep relation. Steady state compressional creep studies of alpha, beta, and gamma uranium were performed using a protective atmosphere. The creep behavior of the anomalously diffusing metals was found to be very similar to that of the normally diffusing metals. The following points are to be noted: (1) steady state creep was diffusion controlled in 5 of the 7 cases studied, and (2) a power law dependence of the steady state creep rate was observed in all cases. Dissert. Abstr.

N74-11332 Vanderbilt Univ., Nashville, Tenn.
THE UNLUBRICATED SLIDING WEAR OF Ti-6Al-4V Ph.D. Thesis
Elias Michael Moore, Jr. 1972 146 p
Avail: Univ. Microfilms Order No. 73-14523

The unlubricated sliding wear of the industrially important titanium alloy Ti-6Al-4V was investigated for couples in the annealed, hydrided, and nitrided conditions. The effects of load and humidity on wear rates and surface topology were determined. The beneficial effects on the wear behavior of surface hardening treatments involving interstitial diffusion, often cited in the literature, were attributed to the reduced ability of the titanium matrix to undergo plastic deformation. All known titanium alloys exhibit essentially the same wear behavior, so the results obtained using the alloy Ti-6Al-4V are considered applicable to titanium and its alloys in general. A technique is suggested by which adherent, wear resistant coatings may be applied to titanium alloys. It is proposed that the titanium oxide be removed by sputter etching, a thin layer of a wear-resistant material such as chromium, nickel, or molybdenum be sputter deposited on the clean titanium surface, and this coating be built up to the desired thickness by conventional means such as electroplating. Dissert. Abstr.

N74-11333 North Carolina State Univ., Raleigh.
THE HYDROGEN-ENVIRONMENT EMBRITTLEMENT OF NICKEL-BASE ALLOYS Ph.D. Thesis
George Ying-Dean Lai 1972 66 p
Avail: Univ. Microfilm Order No. 73-13113

The effect of a 0.9 atmosphere hydrogen environment at ambient temperature on the mechanical properties of a precipitation-strengthened nickel-base alloy, Duranickel, and a dispersion-strengthened nickel-base alloy, TD nickel, was determined. The Duranickel alloy changes from ductile in a solution-annealed condition to brittle in an age-hardened condition when tested in the hydrogen environment. The degree of embrittlement of this alloy by hydrogen is strongly dependent on the microstructures which were developed during the aging treatments prior to testing. The fully strengthened Duranickel alloy, which was aged at 1100 F for 8 hours, is ductile in air, but extremely brittle in the hydrogen environment. The fracture mode of this alloy revealed by scanning electron microscopy changes from transgranular in air to intergranular in hydrogen. Dissert. Abstr.

N74-11334 Societe Creusot-Loire, Paris (France).
CONTACT CORROSION WITH DISPLACEMENT BETWEEN TWO INOX STEELS IN CORROSIVE ENVIRONMENT. ERICTION AND CORROSION JOINT ACTION ON INOX STEELS Final Report [ETUDE DE LA CORROSION DE CONTACT AVEC DEPLACEMENT ENTRE DEUX ACIERS INOXYDABLES EN MILIEUX CORROSIFSRAPPORT FINAL]
A. Desestret and G. H. Wagner Aug. 1972 53 p refs In FRENCH

(Contract DGRST-69-01-796)
Avail: Issuing Activity

Contact corrosion between stainless steels was studied. An experimental devices was built for evaluation of corrosion and measurement of the coefficient of friction in corrosive media. The following conclusions were drawn: mechanical friction leads to a strong depassivation well correlated to mechanical and electro-chemical processes. Electrolytic additives at cathodic potential yield significant improvements; no friction couples were found when the coefficient of friction was lower than 0.2 to 0.4 Various austenitic and martensitic steels were tested in a neutral solution of NcCl at 30 g/liter at ambient temperature.
ESRO

N74-11335*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AQUEOUS CHLORIDE STRESS CORROSION CRACKING OF TITANIUM: A COMPARISON WITH ENVIRONMENTAL HYDROGEN EMBRITTLEMENT
Howard G. Nelson Sep. 1973 30 p refs
(NASA-TM-X-62314) Avail: NTIS HC $3.50 CSCL 11F

The physical characteristics of stress corrosion cracking of titanium in an aqueous chloride environment are compared with those of embrittlement of titanium by a gaseous hydrogen environment in an effort to help contribute to the understanding of the possible role of hydrogen in the complex stress corrosion cracking process. Based on previous studies, the two forms of embrittlement are shown to be similar at low hydrogen pressures (100 N/sqm) but dissimilar at higher hydrogen pressures. In an effort to quantify this comparison, tests were conducted in an aqueous chloride solution using the same material and test techniques as had previously been employed in a gaseous hydrogen environment. The results of these tests strongly support models based on hydrogen as the embrittling species in an aqueous chloride environment. Further, it is shown that if hydrogen is the causal species, the effective hydrogen fugacity at the surface of titanium exposed to an aqueous chloride environment is equivalent to a molecular hydrogen pressure of approximately 10 N/sqm.
Author

N74-11336# Erlangen-Nuremberg Univ. (West Germany).
MANUFACTURE AND PROPERTIES OF TITANIUM AND TITANIUM ALLOYS EMPHASIZING THEIR USE IN AERONAUTICS. PART 1: MANUFACTURE AND PROCESSING [HERSTELLUNG UND EIGENSCHAFTEN VON TITAN UND TITANLEGIERUNGEN UNTER BESONDERER BERUECKSICHTIGUNG DER LUFTFAHRT. TEIL 1: HERSTELLUNG UND VERARBEITUNG]
May 1973 72 p refs In GERMAN Proc. of the 3rd Internal Colloq. of the Mater. Sci. Inst. II, Erlangen, West Ger., 11-12 Oct. 1972 4 Vol.
Avail: NTIS HC $5.75

Aspects of processing and manufacturing titanium and alloys for aircraft structures and parts are highlighted. The manufacturing process of ingots, including the Kroll process for producing sponge metal, and the smelting of electrodes in vacuum furnaces, is described. A review is presented of forming techniques, including drop forging for European Airbus parts. Problems in processing techniques and in the manufacture of aircraft parts are discussed. For individual titles, see N74-11337 through N74-11339.

N74-11337 Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
SMELTING OF TITANIUM AND TITANIUM ALLOYS [ERSCHMELZEN VON TITAN UND TITANLEGIERUNGEN]
Klaus Ruedinger *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys emphasizing their use in Aeron., Pt. 1 May 1973 13 p In GERMAN (For availability see N74-11336 02-17)

The manufacturing process of titanium and titanium alloy ingots is described. The production of titanium sponge results after chlorination of rutile and the Kroll process. Ingots are produced from the sponge metal by pressing them into electrodes, and smelting the electrodes in a vacuum arc furnance. Aspects of quality control are mentioned.
ESRO

N74-11338 Krupp (Fried.) G.m.b.H., Essen (West Germany).
MANUFACTURE OF TITANIUM AND TITANIUM ALLOY SEMIFINISHED PRODUCTS [HERSTELLUNG VON HALBZEUGEN AUS TITAN UND TITANLEGIERUNGEN]
W. Knorr *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys emphasizing their Use in Aeron., Pt. 1 May 1973 30 p refs In GERMAN (For availability see N74-11336 02-17)

A review is presented of forming techniques for titanium and titanium alloys. The following items are discussed: hot forming conditions, processing of the ingots, manufacturing of flat products, and extruding. Methods for quality control are mentioned. Special attention is paid to drop-forged aircraft parts, e.g. for the European Airbus.
ESRO

N74-11339 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
STATUS AND DEVELOPMENT TENDENCIES OF TITANIUM PROCESSING [STAND- UND ENTWICKLUNGSTENDENZEN DER TITANVERARBEITUNG]
Helmut Kellerer and Guenter Gans *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys emphasizing their Use in Aeron., Pt. 1 May 1973 24 p refs In GERMAN (For availability see N74-11336 02-17)

The processing techniques, and the problems involved therein, in the manufacture of titanium and alloy aircraft parts are reviewed. The topics discussed are: deformation, machining, electron beam welding and diffusion welding, surface treatment and heat treatment. It is shown that the difficulties in processing titanium have, in general, been resolved. In present developments the objectives are essentially to reduce production costs, to determine more specifically the effect of the single processing steps on the material properties, and to improve quality control.
ESRO

N74-11340# Erlangen-Nuremberg Univ. (West Germany).
MANUFACTURE AND PROPERTIES OF TITANIUM AND TITANIUM ALLOYS EMPHASIZING THEIR USE IN AERONAUTICS. PART 2: CREEP BEHAVIOR AND THERMAL STABILITY [HERSTELLUNG UND EIGENSCHAFTEN VON TITAN UND TITANLEGIERUNGEN UNTER BESONDERER BERUECKSICHTIGUNG DER LUFTFAHRT. TEIL 2: KRIECH, VERHALTEN UND THERMISCHE STABILITAET]
May 1973 86 p refs In GERMAN Proc. of the 3rd Internal Colloq. of the Material Sci. Inst. II, Erlangen, West Ger., 11-12 Oct. 1972 4 Vol.
Avail: NTIS HC $6.50

Results of investigations concerning the creep properties and the thermal stability of titanium alloys are presented. An analysis is given of the stress-strain-time relations of creep, taking into account creep velocity. Fracture mechanics were applied to investigate and characterize the sensitivity of metallic materials to stress corrosion cracking, and the influence of several parameters is elucidated for titanium alloys. The results of creep tests and thermal stability investigations of TiA16V4, and TiA16V6Sn2, with and without salt corrosion, are reported. The effects of hot and cold working, as well as heat treatment on the creep properties of TiA16V4 are discussed. For individual titles, see N74-11341 through N74-11344.

N74-11341 Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften I.
STRESS-STRAIN-TIME RELATIONS OF CREEP [ZEITSTANDFESTIGKEIT UND SPANNUNGSABHAENGIGKEIT DES KRIECHENS]
B. Ilschner *In its* Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., Pt. 2 May 1973 6 p In GERMAN (For availability see N74-11340 02-17)

The relations between stress and time were analyzed for creep. A definition is given of the stress dependence of creep, which is related to stress relaxation. With a view to analyzing time dependence, the stationary creep velocity was taken into account. It is shown that this velocity is not a function of stress. The stationary state is explained by the compensation of strengthening and recovery processes. The fracture during creep tests is shown to be based on processes along the grain boundaries.
ESRO

N74-11342 Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
APPLICATION OF FRACTURE MECHANICS TO DETERMINE SENSITIVITY OF TITANIUM ALLOYS TO STRESS CORROSION CRACKING [DIE ANWENDUNG DER BRUCHMECHANIK ZUR UNTERSUCHUNG DER EMPFINDLICHKEIT VON TITANLEGIERUNGEN GEGEN SPANNUNGSRISSKORROSION]
Werner Schmidt *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., Pt. 2 May 1973 37 p refs In GERMAN (For availability see N74-11340 02-17)

Fracture mechanics were applied to investigate and characterize the sensitivity of metallic materials to stress corrosion cracking in order to determine real material properties which are independent of the special type of testing. These properties are: the critical stress intensity factor, indicating the initiation of subcritical crack growth, and the crack growth velocity as a function of stress intensity. The basic concepts of fracture mechanics are explained, and the influence of several parameters on both properties is elucidated for titanium alloys. ESRO

N74-11343 Krupp (Fried.) G.m.b.H., Essen (West Germany).
CREEP PROPERTIES AND THERMAL STABILITY OF Ti Al6 V4 AND Ti Al6 V6 Sn2 WITH AND WITHOUT SALT CORROSION [KRIECHVERHALTEN UND THERMISCHE STABILITAET VON Ti Al6 V4 UND Ti Al6 V6 Sn2 MIT UND OHNE SALZKORROSION]
E. Hillnhagen and G. Wirth (DFVLR, Porz, West Ger.) *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., Pt. 2 May 1973 22 p In GERMAN Sponsored by Bundesmin. fuer Verteidigung (For availability see N74-11340 02-17)

The results of creep tests and thermal stability investigations of the titanium alloys TiA16V4 and TiA16V6Sn2, with and without salt corrosion, are reported. The following main conclusions are drawn: (1) damage by salt corrosion was observed at test temperatures up to 150 C; reduction in creep strength and heavy embrittlement are to be counted on from 300 C; (2) the time yield limit for 0.1% plastic deformation after 1000 hours relates to about 75% of the high temperature yield point, both for round bars and sheets; (3) both alloys show no embrittlement without salt layers up to the highest investigated temperatures; and (4) by welding, a reduction of the creep strength up to 300 C is noted, which can be eliminated by heat treatment. ESRO

N74-11344 Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften II.
EFFECTS OF DEFORMING AND HEAT TREATMENT ON THE CREEP PROPERTIES OF TiAl6 V4 [EINFLUSS DER UMFORMUNG UND WAERMEBEHANDLUNG AUF DAS KRIECHVERHALTEN VON Ti Al6 V4]
J. Breme *In its* Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., Pt. 2 May 1973 20 p refs In GERMAN (For availability see N74-11340 02-17)

The effects of hot and cold working, as well as heat treatment, on the creep properties of Ti A16 V4, were investigated. The mechanical properties strongly depend on the grain size, which can be varied by forming and heat treatment. Annealing of a polygonal alpha + beta crystal structure during 90 hours at 880 C, for instance, results in as good a creep resistance at high test temperatures, as for a beta-formed alloy. By means of a favorable segregation of the superstructure phases alpha 2 and omega, obtained by heat treatment in the temperature range 500 to 700 C, the mechanical properties can also be improved. Cold forming combined with precipitation in the 500 to 700 C range results in an improvement of the creep resistance up to 350 C. ESRO

N74-11345# Erlangen-Nuremberg Univ. (West Germany).
MANUFACTURE AND PROPERTIES OF TITANIUM AND TITANIUM ALLOYS EMPHASIZING THEIR USE IN AERONAUTICS. PART 3: FATIGUE STRENGTH AND AGE HARDENING [HERSTELLUNG UND EIGENSCHAFTEN VON TITAN UND TITANLEGIERUNGEN UNTER BESONDERER BERUECKSICHTIGUNG DER LUFTFAHRT. TEIL 3: DAUERFESTIGKEIT UND AUSHAERTUNG]
May 1973 78 p refs In GERMAN Proc. of the 3rd Internal Colloq. of the Material Sci. Inst. II, Erlangen, West Ger., 11-12 Oct. 1972
Avail: NTIS HC $6.00

The effects of the microstrueture on the fatigue life and self-heating of the alloys Ti Al6V4, and Ti Mo11.5 Zr6 Sn4.5 were investigated. It was demonstrated that microstructure has a decisive influence upon fatigue life. The effects of the micro- and macrostructure on the fatigue properties of the alloys Ti Al6V4 and Ti Al6VSn2 were also investigated. Nitinol alloys were analyzed with respect to their age hardening capability, with and without aluminum additives. For individual titles, see N74-11346 through N74-11348.

N74-11346 Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften II.
EFFECT OF MICROSTRUCTURE OF ALPHA PLUS BETA AND ALPHA ALLOYS ON FATIGUE STRENGTH AND SELF-HEATING [EINFLUSS DES GEFUEGEZUSTANDES VON (ALPHA PLUS BETA)- UND BETA ALLOYS AUF DIE DAUERFESTIGKEIT UND DIE EIGENERWAERMUNG]
U. Zwicker and G. Schaller *In its* Manuf. and Properties of Titanium and Titanium-Alloys Emphasizing their Use in Aeron., pt. 3 May 1973 39 p In GERMAN (For availability see N74-11345 02-17)

The effects of the microstructure on the fatigue life and self-heating of the alloys Ti Al6V4, and Ti Mo11.5 Zr6 Sn4.6 were investigated. It was demonstrated that the microstructure has a decisive influence on the fatigue life. For a loading of over 50 kp/sq mm, the microstructure also has an influence on the self-heating of test samples; fracture results from self-heating. In this case, the sample diameters play a more important role. The temperature of the sample can reach 1000 C. ESRO

N74-11347 Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
EFFECTS OF MICRO- AND MACROSTRUCTURE ON THE FATIGUE LIFE OF Ti Al6 V4 AND Ti Al6 V6 Sn2 [EINFLUSS VON MIKRO- UND MAKROGEFUEGEAUSBILDUNG AUF DAS SCHWINGFESTIGKEITSVERHALTEN VON TiAl6V4 AND TiAl6V6Sn2]
Klaus Ruedinger and Albert Ismer *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 3 May 1973 16 p refs In GERMAN (For availability see N74-11345 02-17)

The effects of the micro- and macrostructure on the fatigue properties of the alloys Ti Al6V4 and Ti Al6V6Sn2, were investigated. Results from technical literature were combined with investigations relating to the influence of forming and heat treatment on the microstructure. The effect of the microstructure cannot be uniquely identified. Results of macrostructure experiences indicate reduced fatigue life for coarse structure and longer life for a uniform structure. In relation to forming conditions, differences in fatigue life in different directions are observed. ESRO

N74-11348 Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften II.
AGE HARDENING AND MECHANICAL PROPERTIES OF TiNi (NITINOL) ALLOYS CONTAINING ALUMINUM [AUSHAERTUNG UND MECHANISCHE EIGENSCHAFTEN VON Al-HALTIGEN TiNi (NITINOL)LEGIERUNGEN]
U.-J. Spiering and U. Zwicker *In its* Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 3 May 1973 22 p refs In GERMAN (For availability see N74-11345 02-17)

Investigations of nitinol alloys, with and without aluminum additives, show that age hardening is possible for binary alloys. Aluminum can be dissolved in the intermetallic compound to at least 2.5%, and improves the creep properties at 400 C, whereas the deformation capability is reduced at room temperature. The possibility of manufacturing age hardenable creep- and scale-resistant alloys based on TiNi by optimization of the alloy contents is indicated. ESRO

N74-11349 Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Fonderie.
ADDITION OF LAMELLAR GRAPHITE TO GREY PIG CAST

IRON: COMPARISON OF SOME INDUSTRIAL ADDITIVES [INOCULATION DE LA FONTE GRISE A GRAPHITE LAMELLAIRE COMPARAISON DE QUELQUES INOCULANTS INDUSTRIELS]
Frans Lietaert May 1973 22 p In FRENCH Sponsored by the Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-FD-10) Copyright. Avail: Issuing Activity

Inoculation effects on grey pig iron with graphite laminate produced in an induction furnace, with or without overheating, as a function of chemical composition of industrial inoculants is presented. Parameters considered are tempering strength, number of eutectic cells per sq cm, tensile strength index, hardness index, and quality index. Their variation with the content in C, Si, Ca, Mn, P, S of the industrial additives is discussed with a view to classifying these additives in respect to their efficiency in improving selected mechanical properties. ESRO

N74-11350# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
EFFECT OF TENSILE DEFORMATION AND HEAT TREATMENT ON THE STRESS CORROSION SUSCEPTIBILITY OF AN Al-Zn-Mg ALLOY
C. Shastry and Milton Levy Jul. 1973 28 p refs
(DA Proj. 1T0-62105-A-328)
(AD-766683; AMMRC-TR-73-34) Avail: NTIS CSCL 11/6

The effect of a series of thermomechanical treatments on the stress corrosion susceptibility of an Al-6.86 w/o Zn-2.35 w/o Mg alloy in a 3.5 percent sodium chloride solution was studied by bent beam type stress corrosion tests. The results indicated that for specimens without a room temperature preaging treatment, a 2 percent plastic deformation before the final aging at 150C increased the stress corrosion resistance. No such improvement resulted from a 5 percent deformation. The difference in the stress corrosion susceptibility for the two treatments was attributed to the difference in the dislocation and precipitate distributions in the matrix in the two cases. For both the undeformed specimens and specimens deformed by 2 percent, preaging at room temperature resulted in lower values of stress corrosion time to failure. This reduction in stress corrosion resistance was attributed to incomplete elimination, during aging, of grain boundary solute segregation in the preaged specimens. Author (GRA)

N74-11351# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
FRACTURE TOUGHNESS MEASUREMENTS OF THREE TITANIUM ALLOY EXTRUSIONS
Thomas S. DeSisto Jul. 1973 18 p refs
(DA Proj. 1T0-62105-A-328)
(AD-766682; AMMRC-TR-73-31) Avail: NTIS CSCL 11/6

Plane strain static K sub (Ic) and dynamic, K sub (Id) measurements were obtained on three-inch-diameter titanium alloy extrusions which received a 5.9:1 reduction followed by air cooling. The alloys investigated were Ti-6Al-6V-2Sn, Ti-8Mo-8V-2Fe-3Al, and Ti-11.5Mo-6Zr-4.5Sn (Beta III). Compact tension specimens were used to obtain K sub (Ic) measurements and precracked standard Charpy V-notched specimens were used to obtain K sub (Id) measurements. The highest K sub (Ic) and K sub (Id) values were obtained from the Beta III extrusion while the lowest K sub (Ic) and K sub (Id) values were obtained for the Ti-8Mo-8V-2Fe-3Al extrusion. Good agreement was found to exist between K sub (Ic) values obtained from precracked Charpy V-notch specimens and compact tension specimens. Author (GRA)

N74-11352# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF PLASTIC DEFORMATION AND PHASE TRANSFORMATIONS AT NEGATIVE TEMPERATURES ON THE PROPERTIES OF TITANIUM ALLOYS
I. N. Bogachev, M. A. Dyakova, A. K. Bezrukova, and S. I. Selitskaya 18 Sep. 1973 13 p refs Transl. into ENGLISH from the publ. "Novyi Konstruktsionny Material, Titan" USSR, 1972 p 104-108
(AD-766669; FTD-HT-23-137-74) Avail: NTIS CSCL 11/6

This article investigates titanium alloys alloyed with transition metals like molybenum and vandium. The possibility of non-stable beta-solid solution decompositon during cooling in the negative temperature region and the effect of decomposition products on the mechanical properties of alloys are studied. GRA

N74-11353# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF DELAYED FRACTURE OF PLASTIC TITANIUM ALLOYS
V. N. Mesheryakov and M. Kh. Shorshorov 30 Aug. 1973 14 p refs Transl. into ENGLISH from the publ. "Novyi Konstruktsionny Material Titan" USSR, 1972 p 97-100
(AD-766970; FTD-HT-23-135-74) Avail: NTIS CSCL 11/6

The mechanism of delayed fracture and formation of cold cracks in plastic titanium alloys is examined on the basis of the contemporary dislocation models of Ziner-Stroh, Gilman and Pozhanskiy, Hall and others. The dislocation mechanism of formation of submicroscopic cracks also permits one to establish a basis for the existing concept regarding the effect of hydrogen on brittleness of metals, since it remained unclear as to how hydrogen can be released from solid solution without the presence of ready nuclei of certain size. GRA

N74-11354# Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
COMPARISON OF ALUMINUM ALLOY 7050, 7049, MA52, AND 7175-T736 DIE FORGINGS Final Technical Report, 1 Jun. 1971 - 31 Dec. 1972
James T. Staley Wright-Patterson AFB, Ohio AFML May 1973 130 p refs
(Contract F33615-69-C-1644; AF Proj. 7351)
(AD-766328; AFML-TR-73-34) Avail: NTIS CSCL 11/6

Die forgings in aluminum alloys 7050, 7049, and MA52 were fabricated and evaluated for resistance to stress-corrosion cracking, quench sensitivity, and fracture toughness. In addition, all Alcoa data on 7050, 7049, and special process 7175-T7X die forgings were examined and the properties were collated. Stress-corrosion resistances were evaluated using the severest combinations of forging type and test conditions. All of these newer alloys were less quench sensitive than alloy 7075, and all developed better combinations of resistance to stress-corrosion cracking and fracture toughness than 7075-T6 and 7079-T6 at equal strengths. Because it developed the best combination of properties, alloy 7050 is a preferred selection for use as die forgings of relatively heavy section thickness for the aerospace industry. This alloy also can be supplied as hand forgings, plate, extrusions, and sheet. Special process 7175 is an equally good selection for die forgings of thin to moderate section thickness. Author (GRA)

N74-11355# California Univ., Berkeley. Dept. of Materials Science and Engineering.
AN IRON-NICKEL-TITANIUM ALLOY WITH OUTSTANDING TOUGHNESS AT CRYOGENIC TEMPERATURE
S. Jin, J. W. Morris, Jr., and V. F. Zackay Jul. 1973 22 p refs
(Contract N00014-69-A-0200-1062; NR Proj. 031-762)
(AD-766481; MSE-73-2; TR-2) Avail: NTIS CSCL 11/6

Research has shown that the alloy Fe-12 Ni-0.25 Ti may be processed to have an outstanding combination of strength and toughness at cryogenic temperatures. In this paper the authors present some of the results obtained to date with this alloy, and compare these to the properties of two commonly used cryogenic steels. Tensile properties, impact properties, and preliminary results of fracture tougness tests are presented. (Modified author abstract) GRA

N74-11356# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHASE CHANGES IN ALLOYS OF THE TITANIUM-MOLYBDENUM SYSTEM
S. G. Fedotov, V. S. Lyasotskaya, K. M. Konstantinov, A. A. Jutsenko, and E. P. Sinodova 2 Aug. 1973 13 p refs Transl. into English from the publ. "Novyi Konstruktsionny material-Titan" USSR, 1972 p 37-41
(AD-766570; FTD-T74-01-10) Avail: NTIS CSCL 11/6

The purpose of the paper was to study the structure and properties of the titanium-molybdenum system after hardening and at various phases of change of the hardened structure. GRA

N74-11357# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FEATURES OF ELEMENT DISTRIBUTION IN THE DIFFUSION LAYERS OF A THREE-COMPONENT SYSTEM BASED ON TITANIUM
S. G. Fedotov and M. G. Chudinov 16 Aug. 1973 10 p refs Transl. into ENGLISH from the publ. "Novyi Konstruktsionny Material-Titan" USSR, 1972 p 63-66
(AD-766569; FTD-HT-23-127-74) Avail: NTIS CSCL 11/6

In this paper an attempt has been made to establish the influence of a third element when there is a slight content of it in titanium and vandium (1-3 wt. percent) on their mutual diffusion and the distribution of elements in the diffusion layer. As the third element aluminum and tin were selected, since they increase the stability of a low-temperature hexagonal close-packed (GPU) modification of titanium (alpha-stabilizers), and molybdenum, which, like vanadium, increases the stability of high-temperature face-centered cubic (OTsK) modification of titanium (beta-stabilizers). Author (GRA)

N74-11358# Rutgers Univ., New Brunswick, N.J.
FRACTURE MECHANISMS CAUSED BY SHOCK-INDUCED MICROTWINNING Final Report, Jun. 1972 - Jun. 1973
Victor A. Greenhut Aug. 1973 10 p
(Grant DA-ARO(D)-31-124-72-G189)
(AD-766951; AROD-11061-2-A) Avail: NTIS CSCL 11/6

The shock-induced microstructure of copper was investigated in order to determine the relationship of this substructure to failure. Three substructural modifications were found subsequent to shock-loading: microtwinned regions, cellular dislocation substructure, and fine internal porosity. The morphology of the twinned regions depended upon crystallographic orientation relative to the shock axis. The average dislocation cell size increased with decreasing shock pressure and could be related to calorimetric observations. No cumulative long-range lattice misorientation resulted from shock-loading. The pores were found to be crystallographic in shape and were associated with the failure interface. Moreover, the pores contained structures interpreted as microtwinned regions. Author (GRA)

N74-11359# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
CONTAMINATION HARDENING OF SU-31 AND FS-85 COLUMBIAN ALLOYS
Robert B. Herring Apr. 1973 22 p refs
(DA Proj. 1T0-62105-A-328)
(AD-766679; AMMRC-TR-73-18) Avail: NTIS CSCL 11/6

A study has been made of the contamination hardening of SU-31 and FS-85 columbium alloys which results when samples are exposed in air temperatures of 1400 to 2600 F. Diffusion coefficients for the principal contaminant, calculated from hardening profiles, are in good agreement with data previously reported for diffusion of oxygen in pure columbium. From that agreement it has been concluded that the hardening in the alloys is principally due to the absorption and diffusion of oxygen from the air. Activation energies measured were 22.5 kcal/mol for SU-31 and 20.3 kcal/mol for FS-85. Based on the measurements of this study, SU-31 has a higher resistance to contamination hardening than FS-85 by about a factor of two. Author (GRA)

N74-11360# Army Materials and Mechanics Research Center, Watertown, Mass.
MECHANICAL PROPERTIES AND FRACTURE TOUGHNESS OF Ti-6Al-2Sn-4Zr-2Mo
Charles F. Jr. Hickey and Thomas S. DeSisto May 1973 15 p refs
(DA Proj. 1T0-62105-A-328)
(AD-766681; AMMRC-TR-73-23) Avail: NTIS CSCL 11/6

The purpose of this program was to obtain mechanical property and toughness parameter data for Ti-6Al-2Sn-4Zr-2Mo in two heat-treated conditions. Solution temperatures of 1650 and 1790 F followed by an aging treatment at 1100 F were selected. Variables considered include specimen location and orientation, plus notch orientation for the toughness specimens. Light microscopy, X-ray, and fatigue crack growth patterns were also studied and correlated with the above parameters. The most significant finding in this investigation was the enhancement in toughness parameter data with increased heat treatment temperature. Impact and precracked Charpy (W/A) values were approximately doubled and plane-strain fracture toughness values were increased roughly 17%. Author (GRA)

N74-11361# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
STRESS CORROSION CRACKING SUSCEPTIBILITY AND AGING CHARACTERISTICS OF Al-Zn-Mg-Ti ALLOYS
C. Chen and G. Judd Aug. 1973 23 p refs
(Contract N00014-67-A-0117-0009)
(AD-766838; TR-5) Avail: NTIS CSCL 11/6

A comparison of the stress corrosion cracking (SCC) susceptibility of four aluminum-zinc-magnesium alloys was determined as a function of processing and composition variables, particularly aging treatment and titanium additions. The SCC tests were performed employing a four point loaded constant moment apparatus in a 3.5% sodium chloride solution at room temperature. The alloys were studied as part of a microstructure and microcomposition characterization program in order to determine the effect of these variables on the SCC susceptibility and mechanical properties of the Al-Zn-Mg system. (Modified author abstract) GRA

N74-11362# Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
MECHANICAL PROPERTIES, FRACTURE TOUGHNESS, FATIGUE, ENVIRONMENTAL FATIGUE CRACK GROWTH RATES AND CORROSION CHARACTERISTICS OF HIGH-TOUGHNESS ALUMINUM ALLOY FORGINGS, SHEET AND PLATE Final Report, May 1971 - Feb. 1973
C. F. Babilon, R. H. Wygonik, G. E. Nordmark, and B. W. Lifka Apr. 1973 248 p refs
(Contract F33615-71-C-1571; AF Proj. 7381)
(AD-766335; AFML-TR-73-83) Avail: NTIS CSCL 11/6

The mechanical properties, including toughness and fatigue, fatigue crack growth rates and corrosion characteristics have been determined for a total of 56 lots of 7049-T73 and 7175-T736 forgings, 7475-T61 and T761 sheet, and 2124-T851 plate. Supplemental data for bare and Alclad 7475 sheet and 2124-T851 plate are also presented. Tables of computed design mechanical properties and typical stress-strain and compressive tangent modulus curves were prepared. The rates of fatigue crack propagation of these products generally do not vary significantly with specimen orientation. Humid and salt fog environments increased the rate of fatigue crack propagation for most specimens. Propagation is slower in 2124-T851 plate than for 2024-T851 plate but rates for sheet alloys 7475-T61, 7475-T761 and Alclad 7475-T61 are essentially equivalent as are rates for 7175-T736 and 7075-T7352 hand forgings. The 7175-T736 forgings, 7475-T761 sheet and 2124-T851 plate have a high resistance to exfoliation while the 7049-T73 forging and the 7475-T61 sheet show some susceptibility to exfoliation. All of the materials are resistant to stress corrosion exfoliation. All of the materials are resistant to stress corrosion cracking when stressed in the longitudinal and long-transverse grain direction. The resistance to SCC in the short-transverse direction of all the materials is representative of the respective alloys and tempers. Author (GRA)

N74-11363# Naval Research Lab., Washington, D.C.
EFFECT OF SHEET THICKNESS ON THE FRACTURE RESISTANCE PARAMETER Kc FOR STEELS Final Report
A. M. Sullivan and J. Stoop 8 Aug. 1973 20 p refs
(NRL Proj. M01-24; RR0220146)
(AD-766785; NRL-7601) Avail: NTIS CSCL 11/6

Definition of fracture resistance for thin-sheet material in terms of the linear-elastic fracture mechanics (LEFM) plane-stress parameter K continues to reveal aspects of its geometrical dependency. The effect of sheet thickness on the K value of three structural steels representing four yield stress levels has been determined over available thickness ranges of 1/32 to 1/4 in. Within this range, less thickness dependence has been observed than was anticipated. The facts that both economy and convenience would be served if fracture resistance for all sheet thicknesses could be estimated from a limited number of specimens have given impetus to several models purporting to explain this dependency in terms of the relative contributions of a surface phenomenon, flat fracture, and a volume-sensitive

mechanism, shear-lip development. Attempts to fit present data to one of the models disclose inadequacies for which there are no apparent immediate solutions. Author (GRA)

N74-11645* Bristol Univ. (England). H. H. Wills Physics Lab.
CALCULATIONS OF ELECTRICAL TRANSPORT PROPERTIES OF LIQUID METALS AT HIGH PRESSURES
R. Evans and Ashok Jain *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 141-145 refs (For availability see N74-11621 02-30)
Copyright. CSCL 11F

N74-11650* California Univ., Berkeley. Dept. of Geology and Geophysics.
MELTING OF IRON BY SIGNIFICANT STRUCTURE THEORY
David A. Leppaluoto *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 175-181 refs (For availability see N74-11621 02-30)
(Grant NSF GA-1682)
Copyright. CSCL 11F

N74-11654* Sheffield Univ. (England). Dept. of Physics.
TRANSPORT PROPERTIES OF LIQUID METAL HYDROGEN UNDER HIGH PRESSURES
R. C. Brown and N. H. March *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 206-209 refs (For availability see N74-11621 02-30)
Copyright. CSCL 11F

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-11364 Ecole Superieure de Chimie, Mulhouse (France). Lab. de Chimie-Physique.
STUDY AND MODIFICATIONS TO CARBON FIBER SURFACES FOR IMPROVED ADHESION TO POLYMERS Final Report [ETUDE ET MODIFICATION DES SURFACES DE FIBRES DE CARBONE EN VUE DE LEUR CONFERER L'ADHESION AUX POLYMERES RAPPORT FINAL]
Jean-Baptiste Donnet, Eugene Papirer, and Helmuth Dauksch Dec. 1972 16 p In FRENCH; ENGLISH summary
(Contract DGRST-69-01-912)
Avail: Issuing Activity

The influence of the oxidation of carbon fibers on their surface reactivity and their adhesion to resins is reported. Two types of fibers obtained from acrylic precursors were studied: the fiber AC (heat treatment temperature H.T.T.: 1100 C) and the fiber AG (H.T.T.: 2700 C). Results show that by oxidation: ozone reacted slowly with both types of fibers; nitric acid, which attacks preferentially the less organized part of the carbons, showed a great difference in reactivity with AG and C fibres; fibers of type AG are able to form graphite oxide. The adhesion of fiber AG to epoxyde resin increased with nitric acid treatment. This increase results from the appearance of a surface rugosity. When a graphite surface layer is formed on the AG fibers, the pronounced increase in adhesion comes essentially from the surface groups which assure a better wetting and bring about the formation of chemical links between fiber and resin. Author (ESRO)

N74-11366*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMICS AND KINETICS OF PACK ALUMINIDE COATING FORMATION ON IN-100
S. R. Levine and R. M. Caves 1973 45 p refs Presented at the 144th Natl. Meeting of the Electrochem. Soc., Boston, 7-12 Oct. 1973
(NASA-TM-X-71423; E-7678) Avail: NTIS HC $4.25 CSCL 11D

An investigation of the effects of pack variables on the formation of aluminide coatings on nickel-base superalloy IN-100 was conducted. Also, the thermodynamics and kinetics of coating formation were analyzed. Observed coating weights were in good agreement with predictions made from the analysis. Pack temperature rather than pack aluminum activity controls the principal coating phase formed. In 1 weight percent aluminum packs, aluminum weight gains were related to the halide pack activator. Solid-state nickel diffusion controlled coating formation from sodium fluoride and chloride and ammonium fluoride activated packs. In other ammonium and sodium halide activated 1 weight percent aluminum packs, gaseous diffusion controlled coating formation. Author

N74-11366*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIBER MODIFIED POLYURETHANE FOAM FOR BALLISTIC PROTECTION Patent Application
Richard H. Fish, John A. Parker, and Robert W. Rosser, inventors (to NASA) Filed 17 Sep. 1973 17 p
(NASA-Case-ARC-10714-1; US-Patent-Appl-SN-398885) Avail: NTIS HC $3.00 CSCL 11D

A closed cell foam is described for ballistic protection which has superior properties to the flamable foams of combustible and/or noxious gas nature. The foam is based on a polyurethane resin and is filled with fibers, preferably glass fibers. The foam has good fire resistant properties and does not produce noxious fumes when heated. It has good mechanical properties and does not require external support. NASA

N74-11367# Explosives Research and Development Establishment, Waltham Abbey (England).
THE EFFECT OF WEATHERING ON THE IMPACT STRENGTH OF NYLONS
D. Sims Mar. 1973 20 p
(ERDE-TN-75; BR36272) Avail: NTIS HC $3.00

Twelve grades of nylon were exposed at a temperature site. The impact strengths of the materials were measured for exposure periods up to 24 months. For all materials the impact strength passes through a maximum falling to a low value after 24 months. Author (ESRO)

N74-11368# Explosives Research and Development Establishment, Waltham Abbey (England).
THE PERMEABILITY OF POLYMER TO GASES, VAPOURS AND LIQUIDS
R. W. Richards Mar. 1973 34 p refs
(ERDE-TR-135; BR35756) Avail: NTIS HC $3.75

The theories and relationships describing the permeability of polymers to gases, vapors, and liquids are reviewed. The effects of temperature and film thickness are described and various methods of measuring permeability are discussed.
Author (ESRO)

N74-11369# Drexel Univ., Philadelphia, Pa.
PROPAGATION OF DISCONTINUITIES IN HETEROGENEOUS ANISOTROPIC PLATES
A. S. D. Wang and D. L. Tuckmantel Aberdeen Proving Ground, Md. BRL Jul. 1973 21 p refs
(Contract DAAD05-70-C-0175)
(AD-766751; BRL-CR-111; RR-72-7) Avail: NTIS CSCL 11/4

Elastic stress waves propagating in thin, laminated composite plates are analyzed on the basis of a lamination theory. The theory is based on the Kirchhoff assumptions, but it includes the effects of shear deformation and rotary inertia, similar to Mindlin's theory for homogeneous isotropic plates. The individual layers comprising the plate are assumed to possess different thicknesses and material properties. In particular, each layer may be arbitrarily anisotropic. Thus, a general coupling in shear, bending, twisting and extensional effects is present in the plate constitutive relations. This coupling results in simultaneously coupled stress waves propagating in the plane of the plate. Several numerical examples involving laminated fiber-reinforced composite plates are presented. Author (GRA)

N74-11370# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
FINITE ELEMENT ANALYSIS SYSTEM FOR THE MECHANICAL BEHAVIOR OF ORIENTED FIBER COMPOSITE

MATERIALS UNDER COMBINED STRESSES Interim Report
Lynn J. Ebert, Timothy J. Griesbach, and P. Kennard Wright 31 May 1973 122 p refs
(Grant AF-AFOSR-2374-72; AF Proj. 9782)
(AD-766963; AFOSR-73-1595TR) Avail: NTIS CSCL 11/4

A study was conducted on the effects of biaxial stress states on composite deformation, especially the plastic flow behavior or unidirectional composites under multiaxial loading conditions. An analytical model was developed which incorporated the effects of plastic flow in the composite under any multiaxial loading without shear. This model relates the internal stress distributions in each of the constituents of the composite (calculated by the finite element method) to the externally applied loads, thus enabling the stress-strain curve of the entire composite to be generated for the particular loading state. Experimental data were obtained in hydraulic bulge tests, four point bending, hydrostatic pressurization and uniaxial tension. Implications of the analytical and experimental results toward the establishment of a plasticity theory for fiber composites are discussed. (Modified author abstract) GRA

N74-11371# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Materials Science.
DEFORMATION OF POLYMERS Final Report, 15 Sep. 1970 - 31 May 1973
Norman Brown 20 Aug. 1973 17 p
(Grants DA-ARO(D)-31-124-71-G22;
DA-ARO(D)-31-124-73-G63)
(AD-766954; AROD-9051-5-MC) Avail: NTIS CSCL 11/9

The deformation of linear polymers was investigated from three viewpoints (1) the microscopic, involved measurements of free volume and the relationship of the intermolecular forces to the yield point, (2) the phenomenological, involved the prediction of non-linear viscoelastic programs of deformation in terms of the creep curves, and (3) environmental crazing at low temperatures, involved the effects of gases on the tensile deformation. Experiments and theories concerning these three viewpoints are presented. Author (GRA)

N74-11372# Massachusetts Inst. of Tech., Cambridge.
THE MECHANISMS OF PLASTIC DEFORMATION OF POLYMERS AND THEIR RATE DEPENDENCE Final Report, 24 Jun. 1971 - 23 Jun. 1973
Arthur P. L. Turner 27 Jul. 1973 25 p refs
(Contract DAHC04-71-C-0037)
(AD-766777; AROD-9410-5-MC; FR-4) Avail: NTIS CSCL 11/9

A research program directed toward gaining an understanding of the molecular mechanisms of large strain deformation in glassy and crystalline polymers has been carried out. The investigation encompassed two types of experimental procedures: deformation experiments on bulk polymers to determine the thermal activation parameters of the rate limiting step of the deformation process, and microscopic examination of deformed samples to determine what types of molecular motions had taken place. Microscopic deformation experiments were performed of polycarbonate and polyethylene. Activation enthalpies, shear activation volumes, and dilatation activation volumes were determined for each polymer. Microscopic studies were performed on extended chain crystalline polyethylene which had a spherulitic structure. The spherulitic structure did not seem to strongly affect the deformation. The behavior of shear bands in polycarbonate is also discussed, and a technique for producing metallic replicas of polymer surfaces is described. (Modified author abstract) GRA

N74-11373# Aerospace Corp., El Segundo, Calif.
TESTING FOR THE RELATIVE SUSCEPTIBILITY OF MATERIALS TO INTERNAL HYDROGEN EMBRITTLEMENT BY ELECTROCHEMICAL TECHNIQUES Technical Report, Jun. 1971 - Jun. 1972
Dennis L. Dull and Louis Raymond 15 Aug. 1973 37 p refs (Contract F04701-73-C-0074)
(AD-766409; TR-0074(4250-10)-1; SAMSO-TR-73-259) Avail: NTIS CSCL 11/4

An electrochemical test method is proposed for determination of the susceptibility of materials to internal hydrogen embrittlement (IHE). The method is based on the assumption that the relative susceptibility of a material depends both on the specific aqueous environment to which the material is exposed and to the dissimilar materials to which it is coupled. Potentiostatic techniques are employed to impress potential on sustained loaded notched round-bar specimens. The result is a plot of impressed potential versus time-to-failure; superpositioning of the resultant curves provides a basis for rating the relative susceptibility of various materials to IHE. Author (GRA)

N74-11374# Naval Ordnance Lab., White Oak, Md.
CARBONIZED POLYMER COATINGS AS SURFACE TREATMENTS FOR CARBON FIBERS Technical Report, 1 Jul. 1971 - 30 Sep. 1972
James V. Duffy 6 Aug. 1973 26 p refs
(AD-766782; NOLTR-73-153) Avail: NTIS CSCL 11/5

Carbonized polymeric coatings on the surface of intermediate and high modulus carbon fibers have been shown to increase the composite shear strength properties. These coatings were most effective when applied to fibers whose surface had previously been oxidized. Concentration of the polymer treatment solutions effected final shear strength properties and the optimum concentration level was between 0.05 0.50%. Intermediate carbonization temperatures (400 800C) improved shear strengths but carbonization at 1000C produced the highest shear strength properties. (Modified author abstract) GRA

N74-11375# North Carolina Univ., Chapel Hill.
EXPERIMENTAL INVESTIGATION OF THE RAPID LOADING OF CLAMPED CIRCULAR PLATES BY AN ELECTRICAL DISCHARGE IN WATER
J. D. Williams, III, F. Y. Sorrell, and R. A. Douglas Aug. 1973 44 p refs
(Contract N00014-68-A-0187)
(AD-766516; TR-73-2) Avail: NTIS CSCL 11/9

A high voltage, high current electrical discharge is used to produce a shock wave in water which is then reflected from a plate in order to produce rapid loading of the plate. Discharge energies of 1400 to 2800 joules are used to load 6 inch diameter polycarbonate (Lexan) clamped circular plates. The center deflection of the plate is measured as a function of time by using a touch wire technique. Large dynamic deflection but very little permanent deformation is observed and the results do not correlate very well with existing models of rigid/plastic deformation. This is attributed to non-linear and very highly time-dependent material properties. In addition, some estimates on the amount of energy transferred from the discharge to the plate and a discussion of scaling of the experiment are given. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-11376# Joint Publications Research Service, Arlington, Va.
LECTURES ON THE THEORY OF COMPLEX SYSTEMS, PART 1
N. P. Buslenko, V. V. Kalashnikov, and I. N. Kovalenko 31 Oct. 1973 298 p Transl. into ENGLISH from the book "Lektsii po Teorii Slozhnykh Sistem" Moscow, Sov. Radio, 1973 p 1-295 2 Vol.
(JPRS-60418-1) Avail: NTIS HC $17.00

A discussion of the problems of constructing mathematical models is reported along with qualitative and quantitative analyses for the class of objects which generalize complex systems in the U.S.S.R. The first part of the book, intended for engineers and students, contains mathematical diagrams of the formalization of complex systems and general methods for their analyses. The second part, intended for specialists, treats modeling on digital computers and mathematical investigations of complex systems. Author

N74-11377# Joint Publications Research Service, Arlington, Va.
LECTURES ON THE THEORY OF COMPLEX SYSTEMS, PART 2
N. P. Buslenko, V. V. Kalashnikov, and I. N. Kovalenko 31 Oct. 1973 306 p refs Transl. into ENGLISH from the book "Lektsii po Teorii Slozhnykh Sistem" Moscow, Sov. Radio, 1973 p 296-598 2 Vol.
(JPRS-60418-2-Pt-2) Avail: NTIS HC $17.50
For abstract, see N74-11376.

N74-11378# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
OPTIMAL INCOMPLETE FEEDBACK CONTROL OF LINEAR STOCHASTIC SYSTEMS Ph.D. Thesis
Robert E. Heath, II Jun. 1973 163 p refs
(AD-766878; DS/MA/73-1) Avail: NTIS CSCL 12/1

The problem of incomplete feedback control of stochastic linear systems is considered. The system is modeled by an uncertain parameter linear differential equation driven by Gaussian white noise and an incomplete observation which is a linear transformation of the states. The optimal control is the linear transformation which minimizes the expected value of a quadratic performance index. For both the finite and infinite time problems, necessary conditions that the optimal control law must satisfy are derived. Time varying and constant gains are considered for the finite time problem. For the infinite time problem only time invariant gains are considered. The gradient derived for the infinite time problem is applied to a flight control design problem. This problem concerns finding feedback gains to improve the lateral handling qualities of an F-4 at two different flight conditions. The resulting control laws give quite adequate aircraft handling qualities for the aircraft at both flight conditions. Author (GRA)

N74-11750 Joint Publications Research Service, Arlington, Va.
APPLICATION OF MATHEMATICAL METHODS AND COMPUTER TECHNOLOGY FOR ANALYSIS OF TRENDS AND FORECASTING OF SCIENTIFIC-TECHNOLOGICAL PROGRESS
G. M. Dobrov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 1-18 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 5-19 (For availability see N74-11749 02-34)

N74-11774 Joint Publications Research Service, Arlington, Va.
ON THE APPLICATION OF QUANTITATIVE METHODS IN STUDIES OF THE HISTORY OF MATHEMATICS
L. Novyy and Ya. Folta *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 234-260 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 235-262 (For availability see N74-11749 02-34)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-11379 Centre National de la Recherche Scientifique, Paris (France). Lab. de Physique de l'Atmosphere.
CONTRIBUTION TO MIDDLE ATMOSPHERE EXPLORATION (OZONE AND MESOSPHERE) Final Report [CONTRIBUTION A L'EXPLORATION DE LA MOYENNE ATMOSPHERE (OZONE ET MESOSPHERE)]
A. Vassy Nov. 1972 34 p refs In FRENCH
(Contract DGRST-67-00-589)
Avail: Issuing Activity

The construction of ozone sondes and operation of an ozonometry ground station at Valensole (France) is presented. One sonde is optical with P and T transducers; the two others are chemical, using the MAST chemical transducer either in autonomous mode or coupled to the regular meteorological sonde. The Valensole station is described with emphasis on its ability to perform the complete measurement cycle as recommended by international cooperation programs. Other studies reported deal with: comparison between ozone profiles and meteorological situation after 4 days delay with application to weather forecasting; thunderstorm analysis airborne or ground based showing the influence of ground brush discharges in ozone formation; utilization of ozone as atmospheric tracer; aerosol layer studies at 20 km altitude by passive satellites; aerosol formation during eclipse below the ozone maximum; spaceborne spectrometer construction for mesosphere ozone variation at sunrise. ESRO

N74-11380 Electricite de France, Chatou. Div. Echanges Atmospheriques.
INTEREST AND FEASIBILITY STUDY OF ATMOSPHERIC TURBULENCE AND THERMAL GRADIENTS SIMULATION Final Report [RECHERCHES SUR L'INTERET ET LES POSSIBILITES DE REPRODUCTION EN SIMILITUDE DE LA TURBULENCE ATMOSPHERIQUE ET DES GRADIENTS THERMIQUES]
P. Mery Dec. 1972 26 p refs In FRENCH
(Contract DGRST-69-01-906)
Avail: Issuing Activity

A feasibility study on atmospheric turbulence and thermal gradients simulation is presented. Strict or weak similarity laws are established for the simulation of diffusive phenomena in conditions of neutral stability or instability. The possibility of relating in situ experiments to simulated experiments is assessed. A simulation technique is presented of the atmospheric limit layer for various vertical thermal gradient configurations and associated turbulence. Measurement methods are discussed for direct determination of energy spectra, turbulent intensities, and vertical heat flux of a stratified flow. The required technology for a wind tunnel adapted to simulating industrial air pollution is described, and elements of a 1/5 scale model of such a wind tunnel are presented. ESRO

N74-11381# World Meteorological Organization, Geneva (Switzerland).
SELECTED PAPERS ON METEOROLOGY AS RELATED TO THE HUMAN ENVIRONMENT
1971 166 p refs
(WMO-312; SER-2) Avail: NTIS HC $10.50

Papers are presented on three main topics: large scale atmospheric problems and their possible repercussion on global climates; inter-relation between man and environmental climates; and environmental problems related to hydrology. Among the themes discussed are air pollution and its effect on weather modification; urban climates and resources planning; and pollution aspects of inland and ocean waters. For individual titles, see N74-11382 through N74-11403.

N74-11382 Stockholm Univ. (Sweden). Inst. of Meteorology.
LARGE-SCALE ATMOSPHERIC POLLUTION PROBLEMS AND THEIR POSSIBLE REPERCUSSIONS ON GLOBAL CLIMATE
B. R. J. Bolin *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 3-16 refs Presented at 6th WMO Congr. (For availability see N74-11381 02-20)

A brief account of present knowledge of past changes of the earth's climate is given. Processes of importance for climatic changes over periods up to several thousand years are discussed. These include changes in solar radiation or atmospheric composition and the internal dynamics of the atmosphere-ocean-glacier system. The large-scale pollution caused by man is then discussed under the headings of carbon dioxide, particulate matter, and water vapor. Possible climatic effects of these pollutants are described and models for studying climatic changes are proposed. ESRO

N74-11383 Main Geophysical Observatory, Leningrad (USSR).
THE INFLUENCE OF MAN'S ACTIVITY ON CLIMATE
M. I. Budyko *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 17-19 Presented at 6th WMO Congr. (For availability see N74-11381 02-20)

The problem of modern climate stability is discussed, with reference to the role played by ice cover and glaciation. Using schematic models two possible stable types of climatic conditions were found and these are described. Factors influencing climatic

changes, including dust propagation, carbon dioxide, and energy production, are also discussed. ESRO

N74-11384 National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
SOME GLOBAL TRENDS IN AIR QUALITY AND CLIMATE. A SURVEY
Lester Machta *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 21-30 refs (For availability see N74-11381 02-20)

The processes by which a change in the air composition might modify the climate are discussed. The carbon dioxide concentration in clean air is reviewed and atmospheric particles, especially man-made, are considered as potential climate modifiers. Water vapor as an atmospheric component is discussed together with other constituents, which may modify the climate. ESRO

N74-11385 Environmental Protection Agency, Research Triangle Park, N.C. Air Resources Lab.
WMO'S PLANS FOR MONITORING BACKGROUND AIR POLLUTION
R. A. McCormick *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 31-34 Presented at the 6th WMO Congr. (For availability see N74-11381 02-20)

The concept and primary goal of a global network of WMO background air pollution stations are discussed. The types of stations are described and the monitoring program status is reviewed. ESRO

N74-11386 National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
REGIONAL AIR POLLUTION **c20**
Donald H. Pack and Robert J. List *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 35-42 refs Presented at 6th WMO Congr. (For availability see N74-11381 02-30)

The concept of air pollution as a regional problem is discussed. Regional pollution sources are described and the effects of the pollution noted. An appraisal is made of the regional problem and a definition of an air-pollution region is given. Consideration is given to the requirements of regional models. ESRO

N74-11387 Environmental Protection Agency, Washington, D.C. Coordination and Support Div.
ATMOSPHERIC SURVEILLANCE IN METROPOLITAN AREAS
George B. Morgan *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 43-47 (For availability see N74-11381 02-20)

Air Quality surveillance in urban and metropolitan areas is discussed. The objectives of surveillance, the nature and origin of urban pollutants and pollution considerations in designing a monitoring network are discussed. A brief review of the instrumentation and methods available, including laboratory support and data acquisition, is given. ESRO

N74-11388 Meteorological Office (Gt. Brit.). Boundary Layer Research Branch.
METEOROLOGICAL ASPECTS OF LOCAL HIGH-CONCENTRATION AIR POLLUTION
F. Pasquill *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 49-54 refs (For availability see N74-11381 02-20)

The stages of discharge into the atmosphere of gases and small particles from combustion and chemical processes are described. Theoretical treatments of dispersion and practical systems for estimating dispersion are discussed together with the sources of pollutants. The complexities of weather and terrain are summarized and the transformation and natural removal of pollutants is considered. ESRO

N74-11389 California Univ., Los Angeles. Dept. of Meteorology.
IMPLICATIONS OF INTENTIONAL WEATHER AND CLIMATE MODIFICATION OF THE HUMAN ENVIRONMENT
Morris Neiburger *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 55-61 refs (For availability see N74-11381 02-20)

The various proposals for modification of weather and climate are briefly outlined and their present status is reviewed. The initial effects of such modifications are considered and the inadvertent consequences of weather modification activities, both those which are presently being carried out and those which have been proposed, are appraised. The research required for weather modification is summarized and the needs for international agreements, procedures, and controls is stressed. ESRO

N74-11390 Maryland Univ., College Park. Dept. of Geophysical Sciences.
INTERACTION OF MAN AND HIS ATMOSPHERIC ENVIRONMENT
Helmut E. Landsberg *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 65-72 refs Presented at 6th WMO Congr. (For availability see N74-11381 02-20)

The effects of climate and atmospheric conditions on man's environment are reviewed. Among the topics discussed are diseases, crops, storms, and pollution. The influence of man on climate is also assessed with emphasis on the heat generated in urban areas. ESRO

N74-11391 Uppsala Univ. (Sweden). Div. of Hydrology.
THE QUALITY OF AIR AS A RESOURCE TO SUPPORT LIFE
E. Eriksson *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 72-79 (For availability see N74-11381 02-20)

The importance of air quality to the continued existence of life is discussed. The composition and evolution of the atmosphere are reviewed, and the influence of geophysical events on air quality is considered. The relationship between plants and air and animals and air is described, and the psychological effects of air quality are noted. Future prospects are assessed. ESRO

N74-11392 University Coll., London (England). Dept. of Geography.
URBAN CLIMATES
Tony J. Chandler *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 81-84 Presented at 6th WMO Congr. (For availability see N74-11381 02-20)

The nature of urban climates and their bearing upon the quality of the human environment is discussed. The effects of urban areas on air motions, air pollution, radiation exchange and the heat balance, and precipitation are considered. ESRO

N74-11393 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.
THE APPLICATION OF METEOROLOGY TO LAND-USE PLANNING AND INDUSTRIAL SITING
James T. Peterson *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 85-87 (For availability see N74-11381 02-20)

The application of meteorology and climatology to problems involving land use, city planning, and industrial siting is discussed. It is considered that climatological advice can help determine the course of development in considering such factors as the influence of industrial air-pollutant emissions and the possibility of increasing recreational facilities. The climatic components - wind, heat balance, air quality - and their influence on planning and siting are also discussed. ESRO

N74-11394 Royal Inst. of Tech., Stockholm (Sweden). School of Architecture.
BUILDING CLIMATOLOGY
Harriet Ryd *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 87-92 (For availability see N74-11381 02-20)
Avail: NTIS

In order to reduce to a minimum the climatic wear on buildings, it is necessary to have a knowledge of the different aspects of building climatology. The basic data for this is the macroclimatic changes at various levels - regional, urban, and the building itself. The interdisciplinary asepcts of the climate - pollution, heat balance, air circulation - are reviewed, and their influence on the cost of building construction is considered. The

human requirements in relation to the climatic environment are also noted. ESRO

N74-11395 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.
APPLICATIONS OF METEOROLOGY TO NATURAL RESOURCE PLANNING
James T. Peterson *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 93-100 (For availability see N74-11381 02-20)
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The application of meteorology to the planning and management of natural resources is discussed. Weather components - frost, rain, wind, erosion - having an effect on agriculture, forestry, and recreational facilities are reviewed. Energy natural resources are considered, and ways of getting better utilization are discussed. Finally man's effect on natural ecological systems is described. ESRO

N74-11396 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
SAHARIZATION: NATURAL CAUSES OR MANAGEMENT?
H. Flohn *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 101-106 refs Presented at 6th WMO Congr. (For availability see N74-11381 02-20)

The increasing demand for water in arid or semi-arid countries which has led to a gradual depletion of ground water resources is discussed. The water budget in various countries is reviewed and ways to improve the resources are briefly considered. ESRO

N74-11397 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGY AND NATURAL DISASTERS
In its Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 107-112 (For availability see N74-11381 02-20)

Natural disasters of meteorological origin such as: tropical cyclones, tornadoes, droughts, and floods are considered together with the need for improved storm warning systems. Particular reference is made to the international role of the WMO in giving assistance and the exchange of information. ESRO

N74-11398 Hydrometeorological Service of the USSR.
INTERACTION OF MAN AND HIS ENVIRONMENT. PRESENT SITUATION AND PROSPECTS FOR THE FUTURE c05
Evgeniy Konstantinovich Fedorov *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 115-125 refs (For availability see N74-11381 02-20)

The interaction of human society with the environment is traced and discussed. Reference is made to mineral deposits and exploitation, utilization of natural resources, water and air pollution, and variations in climate. The conditions under which man can survive in his environment are presented. ESRO

N74-11399 Canada Centre for Inland Waters, Burlington (Ontario).
METEOROLOGICAL ASPECTS OF GREAT LAKES POLLUTION
J. P. Bruce *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 127-132 refs Presented at 6th WMO Congr. (For availability see N74-11381 02-20)
Avail: NTIS

The major pollution problems affecting the Great Lakes are outlined and the bearing of meteorological factors on the study and solution of these problems is indicated. The problems are essentially those of entrophication, toxic substances, and waste heat. The influence of the atmosphere on the pollution problem is considered under the headings of exchanges of matter between the lakes and the atmosphere, heat exchange, and momentum exchange. The effect of the atmosphere on the quality of the waters is also noted. ESRO

N74-11400 National Inst. for Hydrology and Meteorology, Warsaw (Poland).
VISTULA RIVER POLLUTION PROBLEMS AS RELATED TO THE RIVER'S HYDROLOGICAL REGIME c13
E. Bobinski *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 133-140 ref Presented at 6th WMO Congr. (For availability see N74-11381 02-20)
Avail: NTIS

The hydrological details and the pollution aspects of the Vistula River in Poland are presented. The various pollutants such as: sewage, minerals, and salts are discussed together with the dissolved and suspended matter content. The feasibility of water use from the river is discussed and projects for water management are outlined. ESRO

N74-11401 World Meteorological Organization, Geneva (Switzerland).
POLLUTION ASPECTS OF INLAND WATERS c13
In its Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 141-143 (For availability see N74-11381 02-20)

The major problems caused by pollution of rivers and lakes are discussed. The minimization of pollution either by controlling pollutant input or by regulating the stream flow is considered. The effects caused by pollution discharges are noted and the need for and use of hydrological monitoring networks is described. ESRO

N74-11402 Heidelberg Univ. (West Germany). Inst. fuer Physik.
ATMOSPHERE/OCEAN RELATIONSHIP IN THE GLOBAL ENVIRONMENTAL POLLUTION
K. O. Muennich *In* WMO Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 145-147 refs Presented at the 6th WMO Congr. (For availability see N74-11381 02-20)

The different transfer mechanisms which carry aerosols, vapors, and gases from the atmosphere into the oceans are described and the role of these pollutants in the global environment pollution scale is discussed. ESRO

N74-11403 World Meteorological Organization, Geneva (Switzerland).
POLLUTION ASPECTS OF OCEAN WATERS
In its Selected Papers on Meteorol. as Related to the Human Environ. 1971 p 149-151 (For availability see N74-11381 02-20)
Avail: NTIS

The atmosphere as a source of ocean pollution is discussed and the transfer mechanisms are described. Other sources of ocean pollution such as off-shore mining for mineral exploitation and oil spills are also considered. The need for monitoring pollutants and forecasting oil spill movements in a systematic manner on a global scale is stressed. ESRO

N74-11404# World Meteorological Organization, Geneva (Switzerland).
APPLICATION OF METEOROLOGY TO MARINE INTERESTS
1973 14 p refs Proc. of the 6th Session of the Comm. for Marine Meteorol., Tokyo, 9-21 Oct. 1972
(WMO-352; MSA-8) Avail: NTIS HC $3.00

The general features of typhoons and storms in the western north Pacific are presented, and the activities of the Japan Meteorological Agency to minimize marine disasters is discussed. The marine service program of the U.S. National Weather Service as it involves warnings of storm surges and tides is described, and the efforts to extend this program to all anomalous water levels are discussed. Experience of the Hydrometeorological Service of the U.S.S.R. in providing services to mariners and fisheries in northern waters is described. For individual titles, see N74-11405 through N74-11407.

N74-11405 Japan Meteorological Agency, Tokyo.
ON THE ACTIVITIES OF THE JAPAN METEOROLOGICAL AGENCY IN RELATION TO THE PREVENTION OF CALAMITIES DUE TO STORMS
Kozo Hishida *In* WMO Appl. of Meteorol. to Marine Interests 1973 p 1-14 (For availability see N74-11404 02-20)

The general features of typhoons and spring gales in the western north Pacific are discussed. Detailed descriptions of some typhoons and the resulting calamities are provided. The efforts

of the Japanese Meteorological Agency to minimize marine disasters are discussed. ESRO

N74-11406 National Weather Service, Silver Spring, Md.
FORECASTING OF ANOMALOUS WATER LEVELS FOR MARINE AND COASTAL INTERESTS
Max-W. Mull- *In* WMO Appl. of Meteorol. to Marine Interests 1973 p 15-26 refs (For availability see N74-11404 02-20)

The marine service program of the U.S. National Weather Service as it involves warnings of storm surge of storm tide, and the efforts during the past year to extend this program so as to include daily advisories concerning all anomalous water levels that (1) are primarily meteorological in nature, (2) are needed, and (3) can be provided within resources. The method for documenting the requirements is discussed, and the plans for implementing the service program are described.
Author (ESRO)

N74-11407 Hydrometeorological Service of the USSR.
EXPERIENCE OF THE HYDROMETEOROLOGICAL SERVICE OF THE USSR IN PROVIDING SERVICES TO MARINERS AND FISHERIES IN NORTHERN WATERS AND THE ATLANTIC OCEAN
F. S. Terziev *In* WMO Appl. of Meteorol. to Marine Interests 1973 p 28-43 (For availability see N74-11404 02-20)

Experimental work in the organization of comprehensive hydrometeorological services for the benefit of shipping and the fishing industry in northern waters and the Atlantic Ocean is described. The background of the service is reviewed, and the methods of ensuring timely transmission of forecasts are described. The results of the services are summarized. ESRO

N74-11408# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FOURTH SESSION OF THE TROPICAL EXPERIMENT BOARD Global Atmospheric Research Programme
1973 133 p refs Conf. held at Geneva, 19-21 Mar. 1973 Prepared jointly with Intern. Council of Sci. Unions
(GARP-Spec-Rept-9) Avail: NTIS HC $8.75; WMO, Geneva

Progress on the GARP GATE program is reported. The subprograms, which together with the central-program will constitute the overall GATE experiment in 1974, are outlined and the status is given of various agreements and programs.
ESRO

N74-11409# World Meteorological Organization, Geneva (Switzerland).
REPORT ON SPECIAL OBSERVING SYSTEMS FOR THE FIRST GARP GLOBAL EXPERIMENT
1973 48 p Meeting held at Geneva, Feb. 1973 Prepared jointly with Intern. Council of Sci. Unions
(GARP-Spec-Rept-10) Avail: NTIS HC $4.50; WMO, Geneva

The World Weather Watch conventional upper air and surface networks are reviewed for the basic observing system of the global experiment of the Global Atmospheric Research Program. The use of polar-orbiting satellites was examined for determining air temperature profiles and of geostationary satellites for measuring cloud motions and cloud heights. Components for special observing systems, including carrier balloon systems, supplementary temporary stations, aircraft reports, constant-level balloons, and buoys were studied. Observing systems simulation experiments such as four-dimensional data simulation and generation of winds were outlined. Recommendations are made on the measurement of winds in the equatorial belt and on observations of Southern Hemisphere mid-latitude mass and motion fields. A Tiros-N substitute spacecraft carrying the appropriate data collection and location equipment is also recommended. ESRO

N74-11410# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: SIXTH STATUS REPORT ON IMPLEMENTATION
Jul. 1973 218 p
(WMO-360) Avail: NTIS HC $13.00; WMO, Geneva

The status and implementation of the global observing system, the global data-processing system and the global telecommunication system of the World Weather Watch (WWW) are presented. The information is based on reports received from members of WMO and other countries during the first half of 1973. Substantial improvements in the WWW have been made in the last year. The information is presented in tables which give global and regional data, and in the form of charts and diagrams. Methods of improvement, such as national resources, UNDP, bilateral programs and the WMO Voluntary Assistance Program, are indicated. ESRO

N74-11411# World Meteorological Organization, Geneva (Switzerland).
THE COMPLETE ATMOSPHERIC ENERGETICS EXPERIMENT Global Atmospheric Research Program
K. Y. Kondratyev Jun. 1973 57 p refs Prepared jointly with Intern. Council of Sci. Unions
(GARP-Publ-12) Avail: NTIS HC $5.00; WMO, Geneva

In the context of the Complete Atmospheric Energetics Experiment complete radiation experiments were carried out during three expeditions between 1970 and 1972 in Central Asia. The radiation was measured under both cloudless and overcast skies. Spectral distribution of the shortwave radiative flux divergence and the role of aerosol absorption were determined. The heat balance of the boundary layer of the atmosphere was determined. Preliminary results relating to numerical modelling of atmospheric circulation and variations of climate are discussed. ESRO

N74-11412# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
RESULTS OF STATISTICAL EVALUATIONS OF PHOTOGRAPHIC RECORDS OF VLF ATMOSPHERICS PARAMETERS SUPPLEMENTED BY MONTHLY AVERAGED VALUES OF AZIMUTHAL DEPENDENT ATMOSPHERICS RATES
G. Heydt 27 Jun. 1972 48 p refs
(TB-154) Avail: NTIS HC $4.50

Results are presented of localizations of atmospheric sources by means of direction finding and by measurements of group delay differences. The results obtained from observation periods of four months in the winter and again in the summer were collected on world maps. Marked areas of sources of atmospheric activity are shown. A quantitative supplement of these results is given in the form of monthly averaged atmospheric rates measured as functions of the azimuth. There are different characteristics of the diurnal variations of these rates which correspond to the respective areas of atmospheric sources. Atmospherics coming from the Amazon region, Central America, and Western Africa are caused by heat storms, whereas atmospherics coming from the East coast of North America and from the Mediterranean are due to lightning occuring at front storms. Author (ESRO)

N74-11413# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
FIRST RESULTS OBTAINED DURING PROGRAM X 4 OF THE VLF ATMOSPHERICS ANALYSER NETWORK
G. Heydt and R. Raupach 12 Jul. 1972 93 p refs
(TB-155) Avail: NTIS HC $6.75

First evaluations as presented of atmospheric observations which were carried out within the Fourth Intensification Interval X 4 of the Ten-year Program of the International Commission on Atmospherics Electricity. The results are presented by graphical surveys which present the behavior of the observed atmospheric parameters. Direction finding and records of the respective group delay differences and the spectral amplitude ratios during the observation period led to knowledge of thunderstorms which were located in South- and Central America, at the eastcoast of North America, on the North Atlantic, in West- and Equatorial Africa, in the area of the Mediterranean, in Indonesia, on the Pacific, and in the Indus region. Some comments on the results are given along with comparisons of weather maps and satellite cloud photos. Author (ESRO)

N74-11414# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
METHODS OF PRESENTING CLIMATOLOGICAL INFORMATION FOR USE IN PLANNING AND SUPPORTING WEATHER SENSITIVE OPERATIONS Final Report, 1 Apr.

1970 - 30 Jun. 1973
Donald E. Martin, Lous J. Hull, and Edwin Chin 30 Jun. 1973 75 p refs
(Contract F19628-70-C-0247; AF Proj. 8624)
(AD-766464; AFCRL-TR-73-0398) Avail: NTIS CSCL 04/2

The research considered the devising of climatic presentations for usage in preparing 2- and 4-hour forecasts of low ceilings and restricted visibilities and the providing of integrated-wind information within the drop-zone layer in support of paradrop operations. A hierarchy of empirical relationships for estimating the recurrence probabilities under a numer of contingencies are made possible through the use of statistical modelling techniques which act to conserve the data base. These are: (1) a model for generating recurrence probabilities which considers only the latest observed ceiling category, (2) one which incorporates surface wind information, (3) another which includes moisture considerations and (4) one which introduces observed moisture and wind information diagnostically without having to assume the persistency of these variables, or otherwise forecast their behavior, throughout the forecast interval. (Modified author abstract)
GRA

N74-11415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE INTEGRAL WATER CONTENT OF RAIN CLOUDS AND DEPTH OF THE RAIN LAYER BY SHF RADIOMETRIC METHOD
A. G. Gorelik and V. V. Kalashnikov 14 Aug. 1973 15 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Obs. (Moscow), no. 103, 1972 p 31-41
(AF Proj. 3005)
(AD-766563; FTD-MT-24-700-73) Avail: NTIS CSCL 04/2

The report describes an experimental work procedure and equipment for determination of integral water content of clouds not providing precipitation, or of clouds with precipitation in the form of rain. The measurements of the radio emission of cloudy atmosphere are conducted on a radiotelescope with an antenna 3 m in diameter, where the SHF-radiometric equipment of ranges 0.8 and 1.35 cm are established. GRA

N74-11416# Texas A&M Univ., College Station. Dept. of Oceanography and Meteorology.
EVALUATION OF ATMOSPHERIC TRANSPORT AND DIFFUSION Semiannual Report, 15 Jan. - 15 Jul. 1972
Tom E. Sanford Dec. 1972 37 p ref
(Contract DAAB07-68-C-0381)
(AD-766345; ECOM-0381-8-68; SAR-8) Avail: NTIS CSCL 04/2

The report contains a summary of the results obtained from some preliminary experiments with a set of equations designed to describe temporal variations of atmospheric parameters within and above tropical forests. Solutions to the set of equations are obtained on a general purpose analog computer. The solutions presented include time continuous descriptions of winds, temperature, vapor pressure, and trace element concentration at four heights above a tropical forest and three heights within a tropical forest. Author (GRA)

N74-11417# Texas A&M Univ., College Station. Dept. of Oceanography and Meteorology.
EVALUATION OF ATMOSPHERIC TRANSPORT AND DIFFUSION Final Report, 15 Jul. 1972 - 15 May 1973
Tom E. Sanford Jul. 1973 43 p
(Contract DAAB07-68-C-0381; DA Proj. 586)
(AD-766344; ECOM-0381-F-68) Avail: NTIS CSCL 04/2

The report contains a study of the thermal characteristics of the system of equations being used at Texas A and M University for investigation of a tropical forest atmosphere. This system of equations is solved on a general purpose analog computer and provides temporal predictions of wind, temperature, vapor pressure, and tracer concentration. Simulations of the diurnal temperature wave only are compared with typical temperature variations observed under both clear and cloudy skies. Results indicate that the simulated temperatures have general characteristics which are consistent with the major trends in the observed temperatures. Author (GRA)

N74-11418# Army Electronics Command, Fort Monmouth, N.J.
VERTICAL EFFICIENCY OF ACTIVE AND PASSIVE BALLOON TRACKING SYSTEMS FROM A STANDPOINT OF INTEGRATED ERROR
Walter B. Miller and Donald R. Veazey Aug. 1973 27 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-766700; ECOM-5503) Avail: NTIS CSCL 04/2

Vertical efficiency is defined for active and passive balloon tracking systems. This concept is based on intrinsic error characteristics and relates to the capability of the systems to supply a vertical wind profile when subject to certain reliability stipulations. Expressions are derived for the vertical efficiencies of either system when observing a family of fundamental trajectories, and for this family, it is shown that vertical efficiency is expressible in terms of a dimensionless parameter related to balloon rise rate and horizontal wind speed. A fundamental result is the decrease of vertical efficiency with increasing horizontal balloon velocity. This is true for either system discussed, but it is most noticeable in the passive. Of the two systems, the active is shown to exhibit a higher vertical efficiency for all reasonable ranges of fundamental error parameters.
Author (GRA)

N74-11419# Earth Satellite Corp., Washington, D.C.
SATELLITE OBSERVATIONS OF ANOMALOUS LOCAL WIND EVENTS IN THE MEDITERRANEAN REGION Final Report, 15 May 1972 - 15 May 1973
Jack M. Meneely and Earl S. Merritt May 1973 125 p refs
(Contract N62306-72-C-0154)
(AD-767026; EPRF-51-0673-003) Avail: NTIS CSCL 04/2

Significant occurrences of two anomalous local wind phenomena in the Mediterranean region have been examined to determine the relationship between the events and the satellite-observed cloud patterns. The local winds studied are the mistral of the Gulf of Lions and the bora of the northeast Adriatic Sea. Fifteen winter months from the period April 1969-April 1971 were selected for analysis. Criteria were established for determining the most significant cases for further study. For the major mistral events vertical time sections of major meteorological parameters were constructed to assist in understanding the development of the mistral and its relationship to the observed clouds. It was concluded that the appearance of the cloud field can usually allow the more severe mistral cases to be differentiated from the less severe. In the case of the bora, cloud imagery can be of little use for the cyclonic cases and of greater, but limited, use for other cases.
Author (GRA)

N74-11420# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.
STUDY AND INVESTIGATION OF COMPUTER ALGORITHMS FOR THE SOLUTION OF THE SHALLOW-FLUID EQUATIONS AS A MEANS OF COMPUTING TERRAIN INFLUENCES ON WIND FIELDS Final Technical Report
Arthur G. Tingle and Jay R. Bjorklund Jul. 1973 165 p refs
(Contract DAAD07-72-C-0309; DA Proj. 1T1-61102-B-53A)
(AD-766753; TR-73-302-01) Avail: NTIS CSCL 04/2

The report describes the development and documentation of a computer algorithm, containing a two-dimensional shallow fluid model, for calculating the wind field above complex terrain. The optimum finite-differencing procedure employed for numerical solutions of the algorithm is a Lax-Wendroff scheme using the grid points and two time levels in combination with a nine-point low-pass filter. Comparisons of calculated wind field patterns with recent detailed observations of wind circulations above complex terrain show excellent qualitative agreement in the limited cases available for analysis. Additionally, the computer algorithm for the two-dimensional model, when applied to the terrain at White Sands Missile Range, gave results that were consistent with the limited observations available for two example situations. The computer program containing the two-dimensional shallow-fluid model, written in Fortran 5 language and designed for use on a UNIVAC 1108 machine, is discussed. (Modified author abstract) GRA

N74-11421# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE UTAH WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Jun.

1973 181 p refs
(AD-766928; Tech-Paper-73-5) Avail: NTIS CSCL 04/2

The map type catalog is a summarization of information relating to synoptic map types for the Utah window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. (Modified author abstract) GRA

N74-11422# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE GERMAN WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Sep. 1973 181 p refs
(AD-766931; Tech-Paper-73-10) Avail: NTIS CSCL 04/2

The map type catalog is a summarization of information relating to synoptic map types for the German window. The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. (Modified author abstract) GRA

N74-11423# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE WASHINGTON WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Jul. 1973 171 p refs
(AD-766930; Tech-Paper-73-7) Avail: NTIS CSCL 04/2

The map type catalog is a summarization of information relating to synoptic map types for the Washington State window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. (Modified author abstract) GRA

N74-11424# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPING COMPUTER PROGRAMS
Hal W. Wold Jun. 1973 115 p refs
(AD-766929; Tech-Paper-73-6) Avail: NTIS CSCL 04/2

The paper describes the computer techniques and lists the computer programs used in the preparation of map type catalogs. Flow charts are also included. Author (GRA)

N74-11425# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE MONTANA WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold May 1973 183 p refs
(AD-766927; Tech-Paper-73-4) Avail: NTIS

The map type catalog is a summarization of information relating to synoptic map types for the Montana window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. (Modified author abstract) GRA

N74-11426# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE GREAT LAKES WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold May 1973 183 p refs
(AD-766926; Tech-Paper-73-3) Avail: NTIS CSCL 04/2

The map type catalog is a summarization of information relating to synoptic map types for the Great Lakes region window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map types. (Modified author abstract) GRA

N74-11427# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE COLORADO WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Apr. 1973 187 p refs
(AD-766925; Tech-Paper-73-2) Avail: NTIS CSCL 04/2

The map type catalog is a summarization of information relating to synoptic map types for the Colorado window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. (Modified author abstract) GRA

N74-11428# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE WASHINGTON, D. C., WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Mar. 1973 172 p refs
(AD-766924; Tech-Paper-73-1) Avail: NTIS CSCL 04/2

A standardized procedure has been developed to determine the synoptic map types which have occurred over a specified area (window). The map type catalog is a summarization of information relating to these map types for a particular window. (There is a catalog for each of the 14 windows which cover the United States). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. The document contains synoptic data of the Washington, D.C. window. The map type catalog is primarily intended for use with other forecast aids that stratify weather or specific weather parameters by map type. Once the catalog is prepared, a firm foundation has been established for the development of additional operational forecast techniques. (Modified author abstract) GRA

N74-11429# Environmental Prediction Research Facility (Navy), Monterey, Calif.
THE LOW-LEVEL STRUCTURE OF WEAK TROPICAL WAVES: A PRELIMINARY REPORT
Robert W. Fett, Roland E. Nagle, and Walter F. Mitchell Mar. 1973 33 p refs
(AD-766797; ENVPREDRSCHFAC-Tech-Paper-3-73) Avail: NTIS CSCL 04/2

High resolution satellite data, ESSA-5 data and wind data derived from the Applications Technology Satellites (ATS), indicate that weak tropical waves characteristically have associated centers of maximum relative vorticity west of the bisector of the inverted V cloud pattern. Two examples of the high resolution satellite views are shown and discussed. Upper-air analyses and a time-section analysis for an ESSA-5 series used to define the original inverted V cloud pattern are examined. These analyses confirm that a trough axis placed on the west side of the inverted V cloud pattern fits the data more consistently than a trough or streamline axis which bisects this pattern. Finally, objective analyses of an Atlantic inverted V cloud pattern based on winds extracted from geosynchronous satellite views are shown. These analyses indicate that an area of maximum relative vorticity exists on the west side of the inverted V cloud pattern. An anticyclone is found south of the inverted V apex contrary to the inverted V model which requires a trough rather than a ridge or anticyclone in this area. The results of this study suggest that the original inverted V model relating to easterly waves requires modification. Author (GRA)

N74-11225 Meteorological Office (Gt. Brit.).
DEFICIENCIES IN SHIPBOARD OBSERVATIONS
M. E. Robson *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 76-81 refs (For availability see N74-11219 02-13)

N74-11228 Direction de la Meteorologie Nationale, Paris (France).
EVOLUTION OF METEOROLOGICAL OBSERVATION METHODS ONBOARD SHIPS [EVOLUTION DES MOYENS D'OBSERVATION METEOROLOGIQUE A BORD DES NAVIRES]
H. P. Treussart *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 104-115 refs In FRENCH (For availability see N74-11219 02-13)

N74-11238 Norwegian Meteorological Inst., Blindern.
THE NORWEGIAN METEOROLOGICAL MET-BUOY
C. K. Jensen *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 216-223 (For availability see N74-11219 02-13)

N74-11239 Japan Meteorological Agency, Tokyo. Meteorological Research Inst.

MARINE METEOROLOGICAL BUOYS OF THE JAPAN METEOROLOGICAL AGENCY
Y. Kawano *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 244-229 (For availability see N74-11219 02-13)

N74-11246 Japan Meteorological Agency, Tokyo. Meteorological Research Inst.
ON THE PLAN OF AMTEX OBSERVATIONAL PROBLEMS
M. Megata *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 315-325 refs (For availability see N74-11219 02-13)

N74-11248 Scripps Institution of Oceanography, La Jolla, Calif.
THE NORTH PACIFIC EXPERIMENT: A STUDY OF LARGE SCALE OCEAN AND ATMOSPHERE FLUCTUATIONS IN THE PACIFIC
T. P. Barnett *In* WMO Means of Acquisition and Commun. of Ocean Data Vol. 2 1973 p 333-344 refs (For availability see N74-11219 02-13)
(Contract N00014-69-A-0200-6006; Grant NSF GX-32481)

N74-11251 Westinghouse Electric Corp., Annapolis, Md. Oceanic Div.
NATIONAL DATA BUOY SENSOR SYSTEM
G. A. Gilmour and R. H. Cassis *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 365-377 (For availability see N74-11219 02-13)

N74-11256 Atmospheric Environment Service, Downsview (Ontario).
A PROPOSED SHIPBOARD METEOROLOGICAL DATA SYSTEM
R. E. Vockeroth and J. M. Cook *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 426-437 refs (For availability see N74-11219 02-13)

N74-11258 Laboratoire de Meteorologie Dynamique, Paris (France).
THE EOLE EXPERIMENT
P. Morel *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 471-491 refs (For availability see N74-11219 02-13)

N74-11259 Ministry of Posts and Telecommunications, Tokyo (Japan). Radio Research Labs.
AN ANALOG RECEPTION OF THE SSCC PICTURES
O. Ryuguji and H. Tanaka *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 492-498 (For availability see N74-11219 02-13)

N74-11260 Equipment Development Lab., Silver Spring, Md.
NEXAIR: DEVELOPMENT OF A NEW UPPER-AIR SOUNDING SYSTEM
J. Lovkay, Jr. and R. H. Waters *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 499-547 refs (For availability see N74-11219 02-13)

N74-11261 Meisei Electric Co. Ltd., Tokyo (Japan).
COMPUTER-AIDED SHIPBOARD UPPER-AIR OBSERVATION SYSTEM
T. Kurashige *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 548-558 (For availability see N74-11219 02-13)

N74-11262 Meteorological Office (Gt. Brit.).
RADIO-SONDE OBSERVATIONS FROM MERCHANT SHIPS
M. E. Robson *In* WMO Means of Acquisition and Commun. of Ocean data, Vol. 2 1973 p 559-563 (For availability see N74-11219 02-13)

N74-11263 National Center for Atmospheric Research, Boulder, Colo.
ATMOSPHERIC MEASUREMENTS OVER THE TROPICAL OCEANS USING SUPERPRESSURE BALLOONS
V. E. Lally *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 564-566 refs (For availability see N74-11219 02-13)

N74-11264 Reading Univ. (England). Dept. of Geophysics.
THE OPERATION OF RADIOSONDES IN THE BOUNDARY LAYER OVER THE SEA
G. P. Britton *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 567-581 (For availability see N74-11219 02-13)

N74-11265 National Oceanic and Atmospheric Administration, Boulder, Colo.
A NOTE ON THE FM-CW RADAR AS A REMOTE PROBE OF THE PACIFIC TRADE WIND INVERSION
B. R. Bean, R. E. McGavin, and B. D. Warnert *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 582-593 refs (For availability see N74-11219 02-13)

N74-11266* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH RESOLUTION SYSTEM FOR UPPER AIR (TROPOSPHERE) WIND AND TEMPERATURE PROFILE MEASUREMENTS
D. W. Camp and W. W. Vaughan *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 594-600 refs (For availability see N74-11219 02-13)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-11430*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
ATS-5 RANGING RECEIVER AND L-BAND EXPERIMENT, VOLUME 1 Final Report
Sep. 1971 57 p refs 2 Vol.
(Contract NA65-21019)
(NASA-CR-132863) Avail: NTIS HC $5.00 CSCL 17G

The ATS-5 Ranging Receiver and L-band Experiment Final Report contains information describing the L-band ranging receiver and preliminary results of test data obtained in the Mojave station. Also covered is a brief program history and description of the installation and testing phase of the program at Mojave Ground Station. The ranging receiver was designed to utilize tone ranging techniques, with the tones being supplied from the station ATS ranging system. The receiver is used in conjunction with the station L-band transmit/receive system. Author

N74-11431*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY ASSESSMENT OF THE MICROWAVE LANDING SYSTEM REQUIREMENTS FOR STOL OPERATIONS
Clifford N. Burrous, Stuart C. Brown, Tsuyoshi Goka, and Kun E. Park Oct. 1973 151 p refs
(NASA-TM-X-62310) Avail: NTIS Hc $9.75 CSCL 01B

The results of an investigation made to assess the Microwave Landing System (MLS) Requirements for use by civil STOL aircraft are described. The principal MLS characteristics investigated in the report were signal accuracy and volume of coverage. The study utilized a nonlinear six-degree-of-freedom digital simulation of a De Havilland Buffalo C-8A aircraft. Fully automatic control of timed curve flight down to touchdown was simulated. Selected MLS accuracy and coverage parameters for the azimuth, primary elevation, flare evelation and DME signals were varied. The resulting STOL aircraft system performance in following a representative curved flight path was statistically determined. Coverage requirements for STOL aircraft operating in the terminal area environment were also investigated. Author

N74-11432# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERROGATION SCHEDULING ALGORITHMS FOR A DISCRETE ADDRESS BEACON SYSTEM
A. Spiridon and A. D. Kaminsky 17 Oct. 1973 106 p refs

(Contracts DOT-FA72WAI-261; F19628-73-C-0002; FAA Proj. 034-241-012)
(ATC-19; FAA-RD-73-166) Avail: NTIS HC $7.50

Several scheduling algorithms that may form part of the interrogation management function of a discrete address beacon system are described. These include scheduling algorithms that can handle unequal message lengths and types which can schedule a message very rapidly (dynamic scheduling). The algorithms are evaluated in terms of the computation required to execute them and their packing efficiencies. Author

N74-11433*# Linguistic Systems, Inc., Cambridge, Mass.
MODERN BEACONING IN AIRPORTS FOR BAD WEATHER FLIGHTS
E. Stauffert Washington NASA Nov. 1973 16 p Transl. into ENGLISH from Air Tech. (France), v. 9, 1965 p 51-58
(Contract NASw-2482)
(NASA-TT-F-15178) Avail: NTIS HC $3.00 CSCL 17G

The arrangement, sizes, and kinds of airport beacons necessary if aircraft landings are to be made in conditions of poor visibility are discussed. The amount of candlepower needed for a given visibility range is derived. Installation of the beacons, in terms of arrangement with respect to lane markers and angle with the horizontal, and also with respect to the kind of construction used for the runway, is described. Author

N74-11434*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LUNAR ROVING VEHICLE NAVIGATION SYSTEM PERFORMANCE REVIEW
Earnest C. Smith and William C. Mastin Washington Nov. 1973 62 p refs
(NASA-TN-D-7489; M-219) Avail: NTIS HC $3.50 CSCL 17G

The design and operation of the lunar roving vehicle (LRV) navigation system are briefly described. The basis for the premission LRV navigation error analysis is explained and an example included. The real time mission support operations philosophy is presented. The LRV navigation system operation and accuracy during the lunar missions are evaluated. Author

N74-11435# RAND Corp., Santa Monica, Calif.
SOME USER BENEFITS ACHIEVABLE FROM AN ADVANCED AIR TRAFFIC MANAGEMENT SYSTEM
T. F. Kirkwood, G. K. Smith, W. L. Stanley, S. Wildhorn, and R. J. Gladstone Jul. 1973 162 p refs
(Contract DOT-TSC-344)
(R-1320-DOT) Avail: NTIS HC $10.25

A study was conducted to identify and quantify the major benefits to aircraft operators, passengers, and shippers arising from improvements to the air traffic control system. The study emphasized the following subjects: (1) increased terminal area capacity and (2) improved aviation safety. The types of aviation considered were general aviation, certified air carriers, and military operations. The basic measure of the safety improvements is the number of accidents that might be avoided or prevented through introduction of the improved air traffic control system. Author

N74-11436# RAND Corp., Santa Monica, Calif.
COST COMPARISONS OF ADVANCED AIR TRAFFIC MANAGEMENT SYSTEMS
D. J. Dreyfuss, H. E. Boren, Jr., F. Kontrovich, J. R. Lind, P. A. Conine, and N. E. Feldman Jul. 1973 162 p refs
(Contract DOT-TSC-344)
(R-1319-DOT) Avail: NTIS HC $10.25

A study of the cost of the Advanced Air Traffic management Systems for operational use in the latter portion of this century was conducted. The results consist of a cost evaluation of several alternative concepts of air traffic control that differ in the basing of the signal receiver (space or ground), the date of initial operational capability, the level of automation, the structure (centralized or disbursed), and the total system cost. The computer program for conducting the cost estimate comparisons is included. Author

N74-11437# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
MODELS FOR KALMAN FILTERING OF DOPPLER INERTIAL NAVIGATION [MODELLBILDUNG ZUR KALMAN-FILTERUNG DER DOPPLER-TRAEGHEITS-NAVIGATION]
Peter Meissner and Uwe Schoenwandt 15 Mar. 1973 44 p refs In GERMAN
(TB-161) Avail: NTIS HC $4.25

A combination of inertial navigation and Doppler velocity measurements was used for the simulation of Kalman filters. The Kalman filter technique allows a relatively exact evaluation of data produced simultaneously by different navigation methods. A trial was run to explain the divergencies often mentioned in related literature by a lack of complete observability of the chosen models. ESRO

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-11438# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Center.
NATIONAL TOPICAL MEETING ON NEW DEVELOPMENTS IN REACTOR PHYSICS AND SHIELDING, BOOK 1
1972 586 p refs Meeting held at Kiamesha Lake, N. Y., 12-15 Sep. 1972
(Conf-720901-Bk-1) Avail: NTIS HC $15.00 as set of two books

The papers presented at the conference on Reactor Physics are reported. Topics discussed include: reactor physics in the thermal range; reactor theory, and reactor shielding. For individual titles, see N74-11439 through N74-11479.

N74-11439 Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
THE PHYSICS OF PWR REACTORS
R. L. Hellens *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 3-22 refs (For availability see N74-11438 02-22)

Measurements and calculations for operating reactors are reported for use in eliminating the theoretical and cross-section-data errors in design methods. Four areas of pressurized water reactors are discussed including: refinement and extension of lattice theory to account for assembly heterogeneities and isotopes from fission products and depletion changes, methods for describing core depletion effects, evaluation of isotopic sections, and improving techniques employed in power-reactor measurements. F.O.S.

N74-11440 Gulf General Atomic, San Diego, Calif.
PHYSICS OF GAS COOLED REACTORS
Richard C. Dahlberg *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1973 p 23-32 refs (For availability see N74-11438 02-22)

The nuclear characteristics of high temperature gas cooled reactors (HTGR) are discussed with emphasis on the temperature coefficient. Data for the HTGR critical assembly program, and the high temperature lattice test reactor critical program are presented. F.O.S.

N74-11441 Commissariat a l'Energie Atomique, Saclay (France).
PHYSICS OF HIGH TEMPERATURE REACTORS AT THE COMMISSARIAT A L'ENERGIE ATOMIQUE
B. Laponche and F. Morier *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 33-54 refs (For availability see N74-11438 02-22)

The current experimental program on high temperature reactor physics is presented. The main studies are based on the low enriched uranium cycle and the tabular interacting fuel element. A first phase, already completed, deals with buckling, K and reaction rate measurement, in MARIUS, at room temperature: buckling was measured by flux mapping and progressive replacement on a 3.5% enriched UO2 particulate fuel lattice; K

was measured by the null reactivity method (PCTR technique) on a 1% enriched UO2 particulate fuel lattice; spectrum indices and relative conversion ratio were also measured in both lattices. Data analysis was performed using the Apollo code, as part of a general comparison between calculation and experiment covering a variety of uranium fuel types and the three main moderators. Author

N74-11442 Atomic Energy Establishment, Winfrith (England).
SOME PROBLEMS IN THE PHYSICS OF HIGH TEMPERATURE REACTORS
J. G. Tyror, J. R. Askew, and I. Johnstone *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 55-67 refs (For availability see N74-11438 02-22)
Avail: NTIS

To meet the accuracies required for design calculations on HTR systems, detailed theoretical models were developed and validated by comparison with the results of an extensive program of specially designed experiments. The general philosophy is illustrated for two problem areas: resonance capture in granular fuel and within-block power distribution. While some problems still remain in the areas so far studied, the confirmation of the reactivity time predictions at high irradiation is identified as the most significant outstanding question. Author

N74-11443 Atomic Energy Establishment, Winfrith (England).
METHODS FOR THREE DIMENSIONAL FUEL MANAGEMENT STUDIES ON HIGH TEMPERATURE REACTORS
J. R. Askew, D. W. Anderson, and K. G. Pearson *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 68-80 refs (For availability see N74-11438 02-22)

Methods for studying fuel management in high temperature reactors have been developed in the U.K. by extending techniques already applied to the earlier AGR systems. The more severe modelling problems of the new system have demanded innovations to retain the desired accuracy, and improved coarse mesh finite difference algorithms, spectrum models for data condensation to few groups and novel iterative strategies for solving for control rod positions are described. Together they give a rapid three-dimensional power solution of acceptable accuracy. Author

N74-11444 Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ENERGY DEPENDENT CROSS SECTIONS IN THE THERMAL REGION c24
B. R. Leonard, Jr. *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 81-96 refs (For availability see N74-11438 02-22)
(Contract AT(45-1)-1830)

The interpretation is presented of neutron cross-section data in the thermal neutron energy region which is complicated by many physical effects which are unique or intensified in this energy region. The problem which causes the greatest uncertainty in the interpretation of thermal cross sections is the inherent lack of information about the exact nature of the negative-energy resonances. This problem is most severe in the interpretation of fission and scattering cross sections. These considerations have been applied to the interpretation of cross section data for several heavy nuclei. Estimates are given of the uncertainties in shapes and values which can be expected in the interpretations of the cross sections. In specific cases these considerations are of value in determining better estimates of the assignments of negative-energy levels and aid in selecting the most probable values from discrepant measurements. Author

N74-11445 Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
PREDICTING PRODUCTION RATES OF HEAVY ACTINIDES
W. E. Graves and R. W. Benjamin *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 97-107 refs (For availability see N74-11438 02-22)
(Contract AT(07-2)-1)

Methods for determining reactor production and depletion rates for heavy actinides based on neutron energy are described. Recent irradiation results, the improved theoretical framework, and the status of cross section data are discussed. F.O.S.

N74-11446 Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
THE EFFECT OF PARTICLES SIZE ON RESONANCE CAPTURE c24
Rubin Goldstein *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 108-113 refs (For availability see N74-11438 02-22)

The effect is calculated of particle size on capture in fuel rods of plutonium and uranium oxide. An analytic expression for the resonance integral is developed as a function of particle size, and experimental verification of the formulation is given. F.O.S.

N74-11447 General Electric Co., Philadelphia, Pa.
THE PHYSICS OF BWR'S
R. L. Crowther *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 115-140 refs (For availability see N74-11438 02-22)

A summary is presented of the status of the physics of BWR's with emphasis on new developments and information gained from operating power reactors. Significant advancements in BWR physics have occurred in the last five years as a result of improvements in the accuracy of both nuclear analysis methods and experimental measurement techniques. Although there has been significant evolution and improvement of experimental and theoretical BWR physics, appreciable incentives for additional improvements still exist. Design advances, particularly those related to plutonium recycle fuel, have created new requirements for both measurements and nuclear methods. The incentives for improved methods and measurements primarily are related to reduction of design margins that are included to allow for potential inaccuracies and to verification of the nuclear characteristics and performance of new designs. Author

N74-11448 Argonne National Lab., Ill.
ADVANCES IN NEUTRON CONTINUOUS SLOWING DOWN THEORY c24
Weston M. Stacey, Jr. *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 143-161 refs Sponsored by AEC (For availability see N74-11438 02-22)

A review is presented of the early theory of continuous slowing-down approximations. This is followed by a discussion of more recent extensions and modifications of the theory. Problems associated with the treatment of resonances and anisotropy are discussed, and extensions to include inelastic scattering are reviewed. Author

N74-11449 University Coll., London (England).
DEVELOPMENT IN VARIATIONAL THEORY AND PERTURBATION METHODS
Jeffery Lewins *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 162-167 (For availability see N74-11438 02-22)

The present usage of variational and perturbation methods in reactor physics is reviewed. Specific areas of application are discussed along with some unresolved problems in conjunction with their usage. D.L.G.

N74-11450 Purdue Univ., Lafayette, Ind. Dept. of Nuclear Engineering.
ADVANCES AND CURRENT PROBLEMS IN REACTOR KINETICS
Karl O. Ott *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 168-178 refs (For availability see N74-11438 02-22)

Advances and current problems in fast reactor dynamics are surveyed. General problems are initially reviewed in order to provide a framework for the discussion of the recent advances. In addition, some results of methodological interest are presented and discussed. Author

N74-11451 Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
GREEN'S FUNCTION COUPLING METHOD FOR TIME DEPENDENT NEUTRON SLOWING DOWN IN HEAVY MEDIA c24
Robert Conn and Mohamed Sawan *In* AEC Natl. Topical Meeting

on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 179-194 refs (For availability see N74-11438 02-22)

An approach based upon the coupling together via Green's functions of distinctly different calculational methods for different time-energy regimes was developed to calculate the time-dependent neutron flux slowing down in a pulsed heavy medium. The initial motivation was based on the need for an accurate, yet inexpensive, method to calculate the time-dependent energy spectrum in the Lead Slowing Down Time Spectrometer. This spectrometer is currently being used for research in fast reactor physics (neutron cross section measurements and evaluation of the statistically-based differential data in the unresolved resonance energy region) and for nondestructive fissile material assay of irradiated or unirradiated reactor fuel pins and subassemblies. Author

N74-11452 Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh. Nuclear Research Center.

A MANY RESONANCE APPROXIMATION FOR THE NEUTRON ENERGY SPECTRUM c24

M. Segev *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 195-206 refs (For availability see N74-11438 02-22)

A many-resonance approximation for the collision density of reactor neutrons is presented. The approximation was found to be particularly accurate in the range of unresolved resonances. The approximation is a smooth, decreasing, function of lethargy, where the rate of decrease is determined by a transcendental equation. A very accurate solution of the transcendental equation was found to be essential and a series expansion of the equation was developed. A study of the effect of a resonance ensemble on the neutron spectrum, based on the properties of the ensemble as a whole, is summarized. Author

N74-11453 California Univ., Berkeley. Dept. of Nuclear Engineering.

PREDETERMINING STATISTICAL ERRORS IN MONTE CARLO TRANSPORT CALCULATIONS c24

Harvey J. Amster *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 207-210 refs (For availability see N74-11438 02-22)

An integral equation is derived for the expected square of the number of collisions in any finite volume of the neutron coordinate phase space. The solutions of these integral equations lead directly to the expected errors of most practical types of Monte Carlo output; for analog Monte Carlo, they also describe the fluctuations in actual physical situations and could be measured experimentally. The integral equation for the expected square of the number of collisions is equivalent to the adjoint transport equation with a particular adjoint source, namely a constant plus a term proportional to the adjoint flux that results from a unit adjoint source throughout the phase space volume in which collisions are to be counted. Author

N74-11454 Argonne National Lab., Ill.

STUDIES OF METHODS FOR FAST NEUTRON MULTI-GROUP CROSS SECTION GENERATION AND THEIR EFFECT UPON THE NEUTRONICS PROPERTIES OF LMFBR CRITICAL ASSEMBLIES

W. M. Stacey, Jr., H. Henryson, II, B. A. Zolotar, R. N. Hwang, B. J. Toppel, C. G. Stenberg, and E. M. Pennington *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 211-228 refs Sponsored by AEC (For availability see N74-11438 02-22)

The sensitivity of the integral neutronics properties of several LMFBR critical assemblies to multigroup cross section generation method was investigated with particular emphasis upon comparison of recently developed and routinely used methods. These studies include resonance algorithms, use of an intermediate group library, the effect of spatial nonuniformity, use of consistent or inconsistent formulations, and the use of different fine-group structures in the averaging of ultrafine group constants. Author

N74-11455 New York Univ., N.Y. Courant Inst. of Mathematical Sciences.

ZERO VARIANCE ESTIMATOR FOR REACTOR CRITICALITY

M. H. Kalos *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 229-239 refs (For availability see N74-11438 02-22)
(Contract AT(11-1)-3077)

A scheme is proposed for biassing in the Monte Carlo solution of reactor criticality problems. Under ideal conditions, which require knowledge and correct use of an adjoint fission neutron distribution, it leads to zero variance estimates of the reactor eigenvalue and other quantities. Practical ways are discussed of obtaining and representing numerical information about this adjoint function. Author

N74-11456 General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.

DETERMINATION OF OPTIMAL k-INFINITY MISMATCH CURVES VIA MODERN CONTROL THEORY

William B. Terney and David C. Wade *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 240-251 refs (For availability see N74-11438 02-22)

The problem of determining the burnup dependence of k-infinity in the loading zones of a reactor core so as to yield the best reactor performance throughout life is treated as an optimal control problem. An iterative solution scheme based on a gradient approach is derived for solving the resulting two point boundary value equations. Results from sample calculations on realistic design models demonstrate the validity and usefulness of the approach. Author

N74-11457 Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

SIMULTANEOUS LINE OVER-RELAXATION (SLOR) IN HEXAGONAL LATTICE c24

H. C. Honeck and J. W. Stewart *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 253-265 refs (For availability see N74-11438 02-22)
(Contract AT(07-2)-1)

A Simultaneous Line Over-Relaxation (SLOR) method was developed for the solution of the one-group difference form of the neutron diffusion equation in regular hexagonal lattices. This method was successfully implemented as a part of a hex-z geometry, multigroup diffusion theory module in the Generalized Reactor Analysis Sub-System (GRASS) of JOSHUA. The theory and equations for the SLOR method are developed and some results are presented. Author

N74-11458 McMaster Univ., Hamilton (Ontario). Dept. of Engineering Physics.

OPTIMUM ANGULAR SEGMENTATIONS IN NEUTRON TRANSPORT ANALYSIS c24

A. A. Harms and W. J. Garland *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 266-274 refs (For availability see N74-11438 02-22)

The problem of specifying optimum angular segmentations in neutron transport analysis is considered. A directional-group representation using partial-range Legendre polynomials is introduced for this purpose. It is found that this solution formalism can be used to specify angular segmentations which minimize the error of certain neutron transport parameters for a given order of approximation. Authro

N74-11459 Assistant Secretary of Defense (Systems Analysis), Washington, D.C.

AN IMPROVED S(N) INNER ITERATION CONVERGENCE CRITERION c24

Gerald L. Atkinson, William Kerr (Mich. Univ., Ann Arbor), and James J. Duderstadt (Mich. Univ., Ann Arbor) *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 275-292 refs (For availability see N74-11438 02-22)

The angular flux form of the S sub N equations in plane geometry is formulated within a mathematical framework which allows an insight into the mechanics of the convergence process. The infinity-norm of the S sub N iteration matrix is explicitly calculated for a problem with a homogeneous isotropically scattering medium. This event allows the calculation of an improved convergence criterion compared to the conventional criterion. This criterion, along with the demonstrated convergence

properties of the S sub N algorithm, guarantees that the fractional iterative error is arbitrarily small. Author

N74-11460 Gulf Energy and Environmental Systems, Inc., San Diego, Calif.
MEASUREMENT AND EVALUATION OF CROSS SECTIONS
V. J. Orphan *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 295-315 refs (For availability see N74-11438 02-22)

Recent advances in techniques for the measurement of total elastic scattering, inelastic scattering, and gamma ray production cross sections, which are important in the shielding of fission and fusion reactors were discussed. A few theoretical calculations of gamma ray production cross sections, which are sometimes used in evaluations, were compared with experimental data. The use of white sources of neutrons with neutron time of flight techniques resulted in improvements in the quality of total cross section data. These same sources are being used increasingly to measure partial cross sections, particularly gamma ray production cross sections, with an accuracy and efficiency not previously achieved with monenergetic neutron sources. Author

N74-11461 Los Alamos Scientific Lab., N.Mex.
DEVELOPMENT OF ENDF/B SHIELDING DATA PROCESSING CODES, AND INTEGRAL TESTS
R. J. LaBauve, R. E. Seamon, C. R. Weisbin, D. R. Harris, and D. W. Muir *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 316-324 refs Sponsored by AEC (For availability see N74-11438 02-22)

The national Evaluated Nuclear Data File (ENDF/B) now contains twelve materials important for shielding applications; these evaluations include data for neutron induced photon production. During fiscal year 1973, photon production data for at least ten more important materials will become available, and six new photon production evaluations will be undertaken. Existing processing codes are being extended and improved, and new codes are being written to fully exploit the extensive data included in the ENDF/B. A comprehensive data testing program under the direction of the Cross Section Evaluation Working Group (CSEWG) is under way to uncover data deficiencies and suggest areas for improvement. Thus the ENDF/B is rapidly becoming the principal and most up-to-date source of data for shielding calculations. Author

N74-11462 Oak Ridge National Lab., Tenn.
SECONDARY GAMMA-RAY-PRODUCTION CROSS SECTIONS OF SEVERAL MATERIALS c24
G. L. Morgan, J. K. Dickens, T. A. Love, and F. G. Perey *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 325-334 refs Sponsored by AEC and DNA (For availability see N74-11438 02-22)

Absolute gamma ray production cross sections were measured as a function of both incident neutron and emitted gamma ray energy for tantalum, iron, silicon, and carbon. The data include gamma ray energies between 0.7 and 10.6 MeV for incident neutron energies up to 20 MeV. Measurements were made at angles of 90 deg and 125 deg for tantalum and carbon and at 125 deg for iron and silicon. Detailed tables of cross sections were transmitted to the National Neutron Cross Section Center. Author

N74-11463 Columbia Univ., New York.
THE MECHANISM OF FAST NEUTRON TRANSPORT IN IRON c24
H. Goldstein, E. Oblow, W. Preeg, J. Ching, E. Troubetzkoy, and L. J. Lidofsky *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 335-348 refs (For availability see N74-11438 02-22)
(Contracts AT(30-1)-73; ORNL-3114)

The behavior of the total and partial cross sections of iron are reviewed, especially as they affect the transport of fast neutrons. It is pointed out that the nonelastic cross sections make iron a very efficient moderator at high energies. Analysis of deep penetration in reflected layers emphasizes the role of minima in the total cross section acting as effective distributed sources which provide for deep penetration. In small bare systems, the high leakage acts as an effective absorption which confines the effect of cross section structure to local penetrations only. The importance of knowing the energy distribution of secondary neutrons from nonelastic processes is underlined. Author

N74-11464 Science Applications, Inc., El Segundo, Calif.
INTEGRAL EXPERIMENTS AND PHILOSOPHY OF BENCHMARK CALCULATIONS
E. A. Straker *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 349-384 refs (For availability see N74-11438 02-22)

The use of integral experiments and reference calculations to help validate cross section libraries and computer codes on radiation transport and shielding problems is discussed. E.H.W.

N74-11465 Gulf Energy and Environmental Systems, Inc., San Diego, Calif.
DEVELOPMENTS IN INTEGRAL SHIELDING EXPERIMENTS INVOLVING FAST-NEUTRON TRANSPORT
L. Harris, Jr. *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 385-396 refs (For availability see N74-11438 02-22)

The role of integral experiments and sensitivity methods in determining probable errors in calculated radiation levels is examined. Data cover the evolution of the two experiments and their analysis of fast neutron transport. A description is given of third generation integral shielding experiments. Author

N74-11466 Columbia Univ., New York.
THE CARBON SHIELDING BENCHMARK PROBLEM AND OTHER NEUTRON TRANSPORT CALCULATIONS IN CARBON c24
H. Goldstein, P. D. Soran, and C. R. Weisbin *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 397-408 refs (For availability see N74-11438 02-22)
(Contract AT(30-1)-GEN-72)

Moments method and S sub N calculations are presented for the scalar neutron fluxes in shielding benchmark problem 1.0 -- an isotropic, fission-like source in a carbon medium. It is found that deep penetration of neutrons in carbon is governed by cross section phenomena which do not affect the penetration at such small distances as are involved in the Benchmark problem. It is, therefore, not yet clear how well existing transport methods can calculate deep penetrations in carbon. Flux-ages-to-indium-resonance energy are calculated for a fission source and a number of monoenergetic sources. Differences between the values given here and those presented elsewhere are correlated with differences in the microscopic cross section sets used. Author

N74-11467 Los Alamos Scientific Lab., N.Mex.
SENSITIVITY OF CALCULATED PULSED SPHERE SPECTRA AND NEUTRON AGE TO CARBON CROSS SECTIONS c24
C. R. Weisbin, R. E. Seamon, D. R. Harris, L. Stewart, R. J. LaBauve, and G. D. Turner *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 409-417 refs Sponsored by AEC (For availability see N74-11438 02-22)

In order to evaluate the adequacy of the present ENDF/B-3 carbon data file (MAT1165) a series of Monte Carlo calculations were performed for both fission and monoenergetic sources. The results for neutron age and higher spatial moments are compared with other available experimental and theoretical values. The present computations were made with the ETOPL processor and the MCN Monte Carlo code. All measurements give consistently higher values for age than the calculations reported here. The precise value of the fission age is clearly sensitive to the total cross section in the KeV region and below. There are no measurements or recent calculations published using ENDF/B-3 data for the 14 MeV age in carbon with which to compare the present result. The value is markedly dependent upon the representation of the secondary energy distribution from the (n,n prime 3 alpha) reaction, and, to a lesser extent, to the description of inelastic angular distributions. To further investigate the suitability of MAT1165 for transport calculations involving finite media, the LLL 2.9 mfp pulsed sphere experiment was calculated. All of the detail observed in the experiment is reproduced, however the calculations still lie significantly below the experimen-

tal curve. The effect of inelastic anisotropy can be clearly observed. Author

N74-11468 Oak Ridge National Lab., Tenn.
THE ORNL SODIUM BENCHMARK EXPERIMENT c24
R. E. Maerker, F. J. Muckenthaler, and C. E. Clifford *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 418-430 refs (For availability see N74-11438 02-22)
(Contract W-7405-eng-26)

The description of an experiment performed at the Tower Shielding Facility is presented which serves as a benchmark for deep neutron penetration through up to 15 ft of sodium. Results of calculations of the experiment are also described, using the MORSE multigroup Monte Carlo code and a preliminary version of the ENDF/B-3 cross section set for sodium. Comparison of the calculations with experiment indicate that the total neutron leakage above thermal energies penetrating 15 ft of sodium can be calculated to within approximately 30% and neutrons penetrating up to 10 ft of sodium to within approximately 10%. Author

N74-11469 Oak Ridge National Lab., Tenn.
FFTF PIPE CHASE STREAMING EXPERIMENT
B. J. McGregor and F. J. Muckenthaler *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 431-441 refs Sponsored by AEC (For availability see N74-11438 02-22)

Two experiments were designed to validate analytical methods which will be used to predict the flux levels in the heat exchanger vault and piping of FFTF reactors. The experimental calculation reported on was a steel lined concrete pipe chase and sodium filled pipe mockup placed in a collimated neutron beam at an angle of 60 deg. Author

N74-11470 Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STATUS OF THE FTR SHIELDING DESIGN ANALYSIS AND METHODS
J. L. Rathbun and P.F. Fox *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 445-458 refs (For availability see N74-11438 02-22)
(Contract AT(45-1)-2171)

Calculation methods and the relationship to the actual shielding design of the fast test reactor are summarized. Particularly difficult shielding analysis areas are described. These areas are the reactor head bulk penetration and streaming problems, the reactor cavity source problem, and streaming into adjacent pipeways and main heat transport cells. The methods of resolution of these problem areas are presented. Author

N74-11471 Hanford Engineering Development Lab., Richland, Wash.
DIFFUSION THEORY ANALYSIS FOR FAST REACTOR SHIELD DESIGN
E. T. Boulette and D. R. Marr *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 459-470 refs (For availability see N74-11438 02-22)
(Contract AT(45-1)-2170)

Comparisons of diffusion theory analyses with transport theory results indicate that diffusion theory adequately calculates integral quantities upon which fast reactor shield experiments support this conclusion and also demonstrate that the neutron cross section library may be adequately represented in fewer than 50 energy groups. Author

N74-11472 Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Div.
CNSG: NUCLEAR SHIP OXYGEN ACTIVATION CALCULATIONAL METHOD WITH EXPERIMENTAL COMPARISON
F. N. Anderson *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 47-479 refs (For availability see N74-11438 02-22)
(Contract CD-2-36216)
(TP-483)

The consolidated nuclear steam generator (CNSG) reactor is being considered for maritime application. In this design, the compactness of the reactor system permits the steam generator to be located inside the pressure vessel. Consequently, the secondary coolant is exposed to a high energy, neutron flux field which activates the oxygen. This creates a radiation exposure hazard to personnel since the transit time of the activated secondary coolant outside the biological shield is small relative to the half life of the activated oxygen. A method is outlined for calculating the oxygen activation and the dose rate associated with the decay gamma rays. This method was used to analyze the oxygen activation in the German nuclear ship, Otto Hahn, which utilizes an earlier version of the CNSG design. Calculated and estimated dose rates are 0.003 and 0.01 mR/h, respectively. Author

N74-11473 Oak Ridge National Lab., Tenn.
FAST REACTOR SHIELDING METHODS DEVELOPMENT
F. R. Mynatt and M. L. Gritzner *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 480-498 refs Sponsored by AEC (For availability see N74-11438 02-22)

A procedure is presented for utilizing the best features of Monte Carlo, discrete ordinates, and diffusion theory in coupled calculations providing good accuracy at minimum expense. As an example, results are presented from a four-step coupled, two dimensional, discrete ordinates calculation for determination of the neutron and secondary gamma ray dose rates in the FTR head compartment. Author

N74-11474 Science Applications, Inc., El Segundo, Calif.
DOMINO: A GENERAL PURPOSE DISCRETE ORDINATES TO MONTE CARLO COUPLING CODE FOR RADIATION TRANSPORT c24
C. E. Burgart, M. B. Emmett, and T. J. Hoffman *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 499-511 refs Prepared in cooperation with Oak Ridge Nat. Lab., Tenn. (For availability see N74-11438 02-22)

The ability to perform two dimensional discrete ordinates calculations and couple the results with three dimensional Monte Carlo calculations makes many calculations practical which would be quite difficult using the Monte Carlo method for the entire calculation. A method of coupling two dimensional discrete ordinates calculations with Monte Carlo calculations of arbitrary geometric complexity is incorporated in the DOMINO code and associated routines. The coupling may take place on either a disk or cylindrical surface; thus the discrete ordinates calculation is limited to r-z geometry. The calculations may be coupled in either a forward mode, adjoint mode, or as a forward-adjoint integration over the surface. The coupling may be performed either exactly or with approximations depending on the boundary conditions and configurations for both calculations. Author

N74-11475 Oak Ridge National Lab., Tenn.
SENSITIVITY ANALYSIS: A GENERAL APPROACH ILLUSTRATED FOR A Na-Fe SYSTEM c24
D. E. Bartine, E. Oblow, and F. R. Mynatt *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 512-523 refs Sponsored by AEC (For availability see N74-11438 02-22)

The definition offered is intended to be both practical and physically meaningful. Its advantages in comparison with other approaches is discussed, and its use in analysis is illustrated for a sodium-iron transport problem. Results of the analysis include a discussion of total cross section minima in deep penetration in sodium and iron, and energy ranges and partial cross sections for the sodium-iron system. The predictive aspect of the approach is demonstrated in comparisons of rigorous and predicted results for small cross section perturbations and in conclusions about the order of Legendre expansion of the scattering kernel. Author

N74-11476 Kansas State Univ., Manhattan. Nuclear Engineering Dept.
CRITICAL COMPARISON AND EVALUATION OF NEUTRON SPECTRUM UNFOLDING CODES: THE NEED TO KNOW c24
W. Meyer and G. A. Mutone *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 524-540 refs (For availability see N74-11438 02-22)

With most on-line fast neutron spectrometry systems it is

not possible to measure directly the energy spectrum of neutrons incident on the detector. The experimental data must be analyzed or unfolded to obtain the spectrum. To accomplish this special analysis, numerous analytical unfolding techniques and computer codes were developed and applied. Author

N74-11477 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SHIELDING APPLICATION OF PERTURBATION THEORY TO DETERMINE CHANGES IN NEUTRON AND GAMMA DOSES DUE TO CHANGES IN SHIELD LAYERS
Daniel Fieno *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding; Book 1 · 1972 p 541-558 refs (For availability see N74-11438 02-22)

Perturbation theory for fixed sources was applied to radiation shielding problems to determine changes in neutron and gamma ray doses due to changes in various shield layers. For a given source and detector position, the perturbation method enables dose derivatives due to all layer changes to be determined from one forward and one inhomogeneous adjoint calculation. The direct approach requires two forward calculations for the derivative due to a single layer change. Hence, the perturbation method for a obtaining dose derivatives permits an appreciable savings in computation for a multilayered shield. A comparison was made of the fractional change in the dose per unit change in shield layer thickness as calculated by perturbation theory and by successive direct calculations; excellent agreement was obtained between the two methods. Author

N74-11478 Wisconsin Univ., Madison. Nuclear Engineering Dept.
NEUTRON AND GAMMA PHYSICS PROBLEMS IN FUSION REACTORS
C. W. Maynard and M. A. Abdou *In* AEC. Natl. Topical Meeting on New develop. in Reactor Phys. and Shielding, Book 1 1972 p 559-573 refs (For availability see N74-11438 02-22)

Neutron and gamma physics problems are presented for fusion reactors, classified as D-T fueled low beta toroidal system. The helium, proton, and atom displacement production rates were used to evaluate radiation damage problems. The (n,2n) reaction rates, as well as the Li-6 and Li-7 tritium production rates, influenced the tritium breeding ratio. The energy deposition rate by the neutrons and the resulting gammas provided the basic input for heat removal studies. Activation of structural and other materials was found to be important for decay heat and hazards studies; and leakage from the shield determined the heat load to the refrigeration system for the superconducting magnets. Author

N74-11479 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
AN EFFECTIVE MULTIPLE-CONSTRAINT SHIELD OPTIMIZATION TECHNIQUE
M. P. Billings *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding; Book 1 · 1972 p 574-576 refs (For availability see N74-11438 02-22)

A general technique was developed and applied to a variety of shield optimization problems. This technique represents system variables, accomodates any number of inequality constraints, presents radiation levels and shield mass on variables, and provides computational efficiency. J.A.M.

N74-11480 Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Center.
NATIONAL TOPICAL MEETING ON NEW DEVELOPMENTS IN REACTOR PHYSICS AND SHIELDING, BOOK 2
1972 617 p refs Meeting held at Kiamesha Lake, N. Y., 12-15 Sep. 1972 ·
(Conf-720901-Bk-2) Avail: NTIS HC $15.00 as set of 2 Books

Fast critical experiments and delayed neutron effect data are applied to obtain the physical parameters for design and development of fast breeder reactors. For individual titles, see N74-11481 through N74-11517.

N74-11481 Argonne National Lab., Idaho Falls, Idaho.
BORON AND TANTALUM CONTROL ROD STUDIES AND ABSOLUTE GAMMA RAY ABSORBED DOSES IN A LMFBR CRITICAL
S. G. Carpenter, G. G. Simons, A. P. Olson, R. W. Goin, and J. P. Plummer *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding; Book 2 · 1972 p 579-598 refs (For availability see N74-11480 02-22)

A set of measurements has been taken on a typical liquid metal fast breeder reactor mockup which provides data against which the components of control rod calculations can be compared for both boron and tantalum. For the central mockup control rod cases, the gamma radiation doses in B4C and Ta were well calculated; in both B4C and Ta the calculated adsorbed doses were predicted within the probable errors assigned to the experimental values. Author

N74-11482 Aktiebolaget Atomenergi, Studsvik (Sweden).
USE OF DATA FROM FAST ASSEMBLIES FOR ADJUSTMENTS OF NEUTRON DATA **c24**
H. Haeggblom *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 · 1972 p 599-612 refs (For availability see N74-11480 02-22)

A series of calculations has been made for obtaining adjusted neutron data by a simultaneous consideration of a large number of integral data from fast reactors. In the first stage, sensitivities of K sub eff and reaction rate ratios to changes in neutron data were calculated. The second stage consisted of a least squares fit of calculated integral data to experimental results. The errors in the integral data and in the energy dependent data were assumed to follow Gaussian distributions. Correlation factors were introduced between a number of energy dependent data. The calculations were based upon 57 integral data from 31 different assemblies and give corrections for 31 neutron data divided into 6 energy groups. The most interesting result was that the adjusted fission cross section in U-235 and the capture cross section in U-238 were significantly lower than the data in ENDF/B-2 over the most important part of the energy region for fast reactors. Author

N74-11483 Aerojet Nuclear Co., Idaho Falls, Idaho.
THE USE OF CFRMF INTEGRAL DATA IN CROSS SECTION EVALUATIONS **c24**
Y. D. Harker and E. H. Turk *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 613-622 refs (For availability see N74-11480 02-22)
(Contract AT(10-1)-1375)

The Coupled Fast Reactivity Measurement Facility (CFRMF) is being used in evaluating neutron cross section data files for the neutron energy range from 1 keV to 1 MeV. The main materials being studied are fission product isotopes where little or no differential data are available. Two methods of measurements are used, capture measurements and reactivity measurements. The results are combined with semi-empirical model calculations to produce evaluated files of differential cross section values. Author

N74-11484 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
EVALUATION AND INTERPRETATION OF INTEGRAL EXPERIMENTS IN FAST CRITICALS
Edgar Kiefhaber *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 · 1972 p 623-635 refs (For availability see N74-11480 02-22)

Activities going on to improve nuclear data and methods of calculation are described, with special emphasis on some of the more recent results. First, the improvements in the group constant sets are considered; this is followed by studies of more specific problems such as the influence of the energy dependence of the fission neutron spectrum, or the difficulties encountered in calculating the reactivity coefficients of reactor materials. Author

N74-11485 Institut fuer Kernenergetik, Stuttgart (West Germany).
MONTE CARLO CALCULATIONS FOR THE CRITICAL EXPERIMENT OF THE GERMAN INCORE THERMIONIC REACTOR
F. A. R. Schmidt, W. Bernnat, and S. Dagbjartsson *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 · 1972 p 636-644 refs (For availability see N74-11480 02-22)

A critical facility for the German Incore Thermionic Reactor (ITR) was established; various measurements were performed at this facility and have been analyzed by the multigroup Monte Carlo code MORSE-K. A short description of this code is given. Among the tasks which had to be solved were the investigation of various cross section libraries, the discussion of geometrical details necessary to describe the facility in calculations and the determination of reactivity worths of different materials at different positions in the reactor. Author

N74-11486 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik.
EXPERIMENTAL RESULTS FROM TWO Pu-FUELED FAST CRITICAL ASSEMBLIES
R. Boehme, E. A. Fischer, P. E. McGrath, and W. Scholtyssek *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 645-659 refs (For availability see N74-11480 02-22)

Two Pu-fueled fast critical assemblies of different enrichment were studied to test cross section data and calculational methods. The measurements suitable for this purpose were central reaction rates and reactivity worths. In addition, measurement of the core material buckling, which characterizes the core material independent of its geometry and surroundings, was also included. The measurement procedures employed are described in some detail. The evaluation of these measurements was done with the most recent cross section sets and computer codes available. A portion of the experiments were also calculated with a cross section set based on ENDF/B data. Author

N74-11487 Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
IMPACT OF THE NEW LASL DELAYED NEUTRON DATA ON FTR DESIGN
S. Ramchandran and K. R. Birney *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 660-686 refs (For availability see N74-11480 02-22)
(Contract AT(45-1)-2171)

Three different sets of delayed neutron parameters were used for evaluating beta sub eff and the lhs to percent delta k/k conversion factor in FTR and its criticals. The impact of using different delayed neutron data in the analysis of critical experiments and FTR design are discussed. The new delayed neutron parameters have particular significance in determining the B-10 poison loading in FTR control rods resulting in a potential improvement in the lifetime characteristics of the poison assemblies. Author

N74-11488 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
MEASUREMENTS OF DELAYED FISSION NEUTRON SPECTRA OF U-235, U-238 AND Pu-239 WITH PROTON RECOIL PROPORTIONAL COUNTERS c24
G. Fieg *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 687-699 refs (For availability see N74-11480 02-22)

The delayed fission neutron spectra of U-235, U-238 and Pu-239 were measured for different time intervals after fission with proton recoil proportional counters. For these measurements, the spectra of the various time groups were determined. 14 MeV neutrons and, for U-235, also thermal neutrons were used to induce fission. Where published experimental group spectra were available, comparisons with these results were made. Author

N74-11489 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik.
MEASUREMENT OF BETA SUB eff IN Pu-FUELED FAST CRITICAL ASSEMBLIES
R. Boehme, E. A. Fischer, and P. E. McGrath *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 700-712 refs (For availability see N74-11480 02-22)

The effective delayed neutron fraction, beta sub eff, and the normalization integral were measured in two mixed-oxide fueled fast critical assemblies, using the apparent reactivity of a Cf-252 source, and traverses of reaction rates. In addition, ratios of beta sub eff values of different isotopes were measured by studying effects of the transport of delayed neutron precursors with a pile oscillator. The evaluation of these measurements was done with the most recent cross section sets available. The experiments give larger beta sub eff values than those calculated with Keepin's data, and indicate that the difference is mainly due to beta of Pu-239 and, to a lesser extent, to beta of U-238. Author

N74-11490 Oak Ridge National Lab., Tenn.
VERIFICATION OF A NEW METHOD FOR CALCULATING AND MEASURING GENERATION TIME IN A SUBCRITICAL FAST REACTOR
A. R. Buhl and J. C. Robinson (Tenn. Univ., Knoxville) *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 713-723 refs (For availability see N74-11480 02-22)

A new method is reported for calculating and measuring the generation time (lambda) in a subcritical fast reactor using a recently developed transfer and scattering kinetics scheme (TASK). The method is an extrapolation of a four-node fluctuations theory in which the generation time in a thermal reactor was shown to be equal to the slope of the tangent of the phase angle from the power spectra between a high-energy-sensitive detector. The TASK method directly computes the prompt die-away time constant and the lambda based on the tangent method. Author

N74-11491 General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept.
GE NUCLEAR DESIGN AND BENCHMARK CRITICAL EXPERIMENT PLAN FOR THE LMFBR DEMONSTRATION PLANT
H. S. Bailey and S. L. Stewart *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 724-738 refs (For availability see N74-11480 02-22)
(Contract AT(04-3)-189)

Background planning related to the LMFBR demonstration plant design provides the basis for the configuration and experiments planned for ZPPR-3. The specified experimental configurations and plans are summarized and some details of the experimental plan for each of the phases are presented. Development and execution of the detailed experimental program involves specifications of the detailed core loadings and arrangement, auxiliary measurements to provide information to determine experimental accuracies or resolve discrepancies, reduction of the experimental data to a useable form for the reactor designers, and analysis before the fact for planning, during the experimental program and after the program. Author

N74-11492 Argonne National Lab., Ill.
ANALYSIS OF SODIUM-VOID EXPERIMENTS IN THE FTR ENGINEERING MOCKUP CRITICAL ASSEMBLY
A. Travelli and J. C. Beitel *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 739-767 refs (For availability see N74-11480 02-22)

A series of sodium-void experiments in the engineering mockup critical assembly of the FTR is analyzed. The computational model is based on X-Y diffusion perturbation theory with ENDF/B-7 data. The analytical procedure yields results in excellent agreement with the experiments and provides a demonstrated tool for the prediction of other sodium-void effects. In addition, the results indicate that the gross heterogeneities of the FTR core, including control rods, sodium channels and test loops, exert an overwhelming influence on the spatial distribution of the sodium-void coefficient throughout the FTR core. Author

N74-11493 Argonne National Lab., Ill.
REVIEW OF FBR PHYSICS
R. Avery *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 771-788 (For availability see N74-11480 02-22)

A qualitative review is made of FBR physics in which primary focus is put on the physics problems facing the fast reactor designer with particular emphasis on current outstanding problems. Some of the problems considered include the central worth discrepancy, Doppler and sodium coefficients, control rod effects, and long term effects related to the fuel cycle. Also discussed is the role and status of the critical experiment program in supplying a base of integral data on large dilute plutonium

systems. The status of some of the major code development activities in the areas of cross section processing, neutron diffusion, and space-dependent kinetics is discussed relative to fast reactor design needs. Author

N74-11494 Argonne National Lab., Idaho Falls, Idaho.
THE DEMONSTRATION REACTOR BENCHMARK PROGRAM
W. G. Davey *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 789-808 (For availability see N74-11480 02-22)

A series of critical studies on the Zero Power Plutonium Reactor (ZPPR) and the Zero Power Reactor (ZRP-6) designs for demonstration sizes 350 to 500 MWe are reported. A realistic assembly of reactor geometry for ZPPR, and a single core with central zones of specific compositions for ZPR-6 were constructed. Design calculations included data on critical size, power distributions, control rod worths, sodium voiding worths, and Doppler coefficients. G.G.

N74-11495 Argonne National Lab., Idaho Falls, Idaho.
SPATIALLY DEPENDENT BENCHMARK PARAMETERS IN THE INITIAL DEMONSTRATION PLANT CRITICAL ASSEMBLY
P. I. Amundson, W. G. Davey, R. G. Palmer, P. J. Collins, S. G. Carpenter, C. L. Beck, R. W. Goin, R. J. Forrester, R. O. Vosburgh, D. W. Maddison et al *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 809-821 refs (For availability see N74-11480 02-22)

The design of PuO2/UO2 fuel reactors, cooled with liquid sodium, and utilizing stainless steel as the primary cladding and structural material is reported. ZPPR Assembly 2 is the first such critical that characterizes most of the physical aspects of the demonstration plant designs presently envisioned. It contains the appropriate composition; the core regions simulate closely the mixed PuO2/UO2 fuel with stainless steel and sodium as structure and coolant compositions in the true power reactor; the blankets similarly simulate sodium cooled steel clad depleted uranium oxide. It has the appropriate geometry; the core is a flattened cylinder with two equal volume zones; the plutonium concentration of the outer zone is 50% higher than that of the inner core to provide power flattening; the axial and radial blankets are of suitable power reactor thickness, bounded by an external steel sodium reflector. Author

N74-11496 Commissariat a l'Energie Atomique, Paris (France). Div. d'Etude et de Developpement des Reacteurs.
REACTOR PHYSICS AND FAST POWER BREEDERS: MASURCA CORE R-Z PROGRAM
J. Y. Barre, J. Boyer, J. C. Mougniot, and B. Sicard *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1973 p 822-838 refs (For availability see N74-11480 02-22)

Fast reactor physics are described, focusing on the MASURCA fast critical facility studies. These experiments concern mainly relative variations versus enrichment of characteristics of lattices fuelled either with plutonium (cores Z) or uranium (cores R) with the same diluent. The major results obtained for asymptotic mode neutron balance parameters (material buckling and spectral indices) and for engineering parameters (power distributions, blankets and control rods) are compared with analysis made using CADARACHE reference data. Conclusions drawn from this analysis are then applied to the main PHENIX predicted parameters. Author

N74-11497 Hanford Engineering Development Lab., Richland, Wash.
FTR NEUTRONICS: STATUS, PROBLEMS AND DEVELOPMENT PROGRAMS
P. L. Hofmann *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 839-887 refs (For availability see N74-11480 02-22)
(Contract AT(45-1)-2170)

The nuclear design features of the FTR are summarized and the more significant nuclear problem areas are pointed out. A description of the nuclear development programs is given and their impact on FFTF design decisions is assessed. Finally, a brief discussion of the plans for nuclear startup and for the irradiation test program are to be presented. Author

N74-11498 Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
EXPERIMENTAL STUDY OF BURN-UP IN FAST BREEDER REACTORS
J. Bouchard, D. Chavardes, M. Darrouzet, J. Gourdon, and M. Robin *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 888-904 refs (For availability see N74-11480 02-22)

An experimental study of burn-up for fast breeder reactors is discussed using the example of the Rapsodie prototype. Three types of measurements have been performed on this reactor: burn-up determination, and measurements of the variations of core composition and blanket composition. The results provide basic data, show trends for the main capture cross sections and absolute values of the neodymium yields. In addition, the experimental techniques and calculation methods have been tested and some conclusions are drawn in view of future studies. Author

N74-11499 Argonne National Lab., Ill.
EBR-II IRRADIATION PHYSICS c24
D. Meneghetti and W. B. Loewenstein *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 905-927 refs (For availability see N74-11480 02-22)

The use of EBR-2 as a fast fuel irradiation facility illustrates its versatility for physics measurements. Its potentials are unique relative to those of the zero power criticals especially in those areas where at-power conditions are important. For example: Power reactivity components, gamma deposition, deep penetration of neutrons and gammas, feedback components, burnup, fission-product productions, and interaction problems of neutronics, gamma, coolant flow, and heat transfer. Author

N74-11500 General Electric Co., New York. Breeder Reactor Dept.
SIGNIFICANCE OF INTEGRAL PARAMETERS IN THE DESIGN AND PERFORMANCE OF FAST BREEDER REACTORS
P. Greebler and B. A. Hutchins *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 928-939 refs (For availability see N74-11480 02-22)

Integral measurements applicable to fast reactor analysis and design have become available from a number of different sources. They play important roles in providing needed fast reactor physics information such as measurement and demonstration of the Doppler coefficient and radiation effects. Briefly discussed is how some of these integral parameters are now used for fast reactor design and operation. Author

N74-11501 Gulf Radiation Technology, San Diego, Calif.
REVIEW OF FAST NEUTRON SPECTRUM MEASUREMENTS c14
C. A. Preskitt, B. K. Malaviya (Rensselaer Polytechnic Inst.), and E. F. Bennett (ANL) *In* AEC Natl. Topical Meeting of New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 943-958 refs (For availability see N74-11480 02-22)

A wide variety of techniques has been used to measure fast neutron spectra. To a large degree, the choice of technique has been dictated by the equipment or technology available at the specific laboratory. In other cases the choice has been dictated by the nature of the system being studied, and by the radiation and thermal environment in which the measurements are made. The available techniques can quite generally be broken down into two broad classes: (1) differential spectrometers, of which neutron time-of-flight is the best example, and (2) integral spectrometers, of which various proton-recoil techniques are the best example. Author

N74-11502 Gulf Radiation Technology, San Diego, Calif.
PROTON-RECOIL PROPORTIONAL COUNTER SPECTROMETRY FOR REACTOR SPECTRUM MEASUREMENTS c14
V. V. Verbinski, J. C. Young, J. M. Neill, R. Gionvannini, and D. H. Houston *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 959-972 refs

(For availability see N74-11480 02-22)
(Contract AT(04-3)-167)

The factors that limit the accuracy of a proton-recoil proportional counter in measuring neutron spectra in reactors are discussed in light of recent detector response measurements and associated calibrations, reactor spectrum measurements with two different counter geometries, unscrambling experience with several different approaches, and comparisons with calculations and time-of-flight measurements. This discussion represents an attempt at a critical analysis of proton-recoil spectrometry in that the approximations and omissions of each method are pointed out and improvements in both method and counter design suggested. The proton-recoil scaler flux spectrum is compared to an angular flux spectrum obtained by calculation and one measured by the time-of-flight method. Author

N74-11503 Argonne National Lab., Idaho Falls, Idaho.
SODIUM VOID STUDIES AND RELATED HETEROGENEITY EFFECTS IN ZPPR-2: THE BENCHMARK DEMONSTRATION ASSEMBLY
R. G. Palmer, W. G. Davey, P. J. Collins, P. I. Amundson, R. E. Kaiser, and C. L. Beck *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 973-985 refs (For availability see N74-11480 02-22)

The primary objective of Argonne's Demonstration Reactor Benchmark Program has been to provide the LMFBR industry with relevant integral data to aid their Demonstration Reactor design studies. In the area of reactor safety one of their major interests has been in the effect on the neutronics of the reactor caused by possible loss of sodium coolant from one or more regions of the reactor under accident conditions. Thus one of the principal studies in the Benchmark Program has been the measurement of those neutronic parameters which are sensitive to changes in sodium density in the reactor and include the sodium reactivity coefficient, Doppler, nautron spectrum and reaction rates. Author

N74-11504 General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept.
SEFOR: VERIFICATION OF THE DOPPLER TRANSIENT SHUTDOWN CAPABILITY OF LMFBR'S
D. D. Freeman, P. Greebler, L. D. Noble, and G. R. Pflasterer *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 986-1005 refs (For availability see N74-11480 02-22)
(Contract AT(04-3)-540)

The SEFOR experimental program was undertaken to demonstrate and to measure the Doppler reactivity feedback in neutron spectra and at fuel temperatures and crystalline states representative of an operating LMFBR. Tests involving both static power reactivity measurements and rapid super-prompt-critical reactivity insertions from power gave good agreement for the Doppler constant in each of two cores. A major achievement of the SEFOR experimental program was the successful completion of the super prompt transient tests. These tests are the only integral measurement of the Doppler effect in an oxide fueled LMFBR at temperatures of interest in power reactor design. They give convincing confirmation of the soundness of the Doppler Theory being applied to LMFBR's and demonstrate the inherent safety and stability of this type of reactor. In addition, the good agreement between pre-experiment analysis and experimental results points up the predictable transient neutronics behavior of oxide fueled LMFBR's. Author

N74-11505 Argonne National Lab., Idaho Falls, Idaho.
ON THE EFFECT OF CORE CONFIGURATION ON U-238 DOPPLER MEASUREMENTS IN ZPPR ASSEMBLY 2
R. E. Kaiser and J. M. Gasidlo *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1006-1015 refs (For availability see N74-11480 02-22)

ZPPR Assembly 2 is a demonstration plant benchmark critical, designed in cognizance of the general design features envisioned by the major LMFBR contractors. The experimental program has been developed by Argonne with appropriate considerations of contractor requirements in order to most effectively answer the problems encountered by them in their early design phase. Of particular interest are measurements related to fast reactor safety, such as the Doppler effect, and its response to changes in reactor configuration. The series of Doppler measurements included in the ZPPR-2 program was formulated so as to provide information on the most important aspects of the problem, such as the effect of sodium-voiding on Doppler-reactivity temperature dependence, and heterogeneity effects which may influence the use of critical experiments to predict power reactor performances. Author

N74-11506 Wisconsin Univ., Madison. Nuclear Engineering Dept.
PULSED-ACTIVATION TECHNIQUES FOR THE MEASUREMENT OF DOPPLER EFFECTS
W. K. Foell, G. J. Russell, D. M. Lucoff, and S. K. Bhattacharyya *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1016-1032 refs (For availability see N74-11480 02-22)

A Doppler measurement technique for application to transient high temperature conditions in a nuclear reactor is discussed. The conditions involved are representative of transient over-power event in a ceramic fueled power reactor. The pulsed activation Doppler technique was selected to provide a reactor control capability and procedures for conducting the evaluation are described. Author

N74-11507 Atomics International, Canoga Park, Calif.
BENCHMARK TESTING OF NUCLEAR DATA FOR FAST REACTORS
Harry Alter *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1033-1047 refs Sponsored by AEC (For availability see N74-11480 02-22)

Integral parameters for a series of fast reactor benchmark assemblies, covering a wide range of energy spectra, were calculated with the reference cross section set ENDF/B-3. Multigroup constants relative to each assembly were generated and used in S sub n transport and/or diffusion theory calculations to obtain the parameters. The calculated parameters include K sub eff, spectral indices (activation ratios), and central reactivity worths. Results of the several calculations indicate a significant improvement in the cross section data of the version 3 reference set over that contained in ENDF/B-2. Author

N74-11508 Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems.
TEDIUM: IDEALIZED NEUTRON DATA FOR TESTING LIBRARY PROCESSING CODES c08
Mahlon Raymund *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1048-1060 refs (For availability see N74-11480 02-22)

Computer codes, generally employed as processors of ENDF/B data, were tested with a set of idealized materials called TEDIUM. Selected tabulations of numerical results show that the ENDF/B data are well interpreted with most differences due to computer strategy features in the ETO codes. Even in the resolved resonance calculations where difficulties are greatest, agreement is usually within 2%. Consequently, reactor calculations from ENDF/B data should proceed with more confidence. Future intercomparisons of ETO results, using real ENDF/B data, are desirable. Author

N74-11509 Argonne National Lab., Ill.
FAST NEUTRON DATA, DIAGNOSIS AND PROGNOSIS
A. B. Smith *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1063-1074 refs (For availability see N74-11480 02-22)

The status of data on nuclear reactions, with emphasis on fast neutron data, is discussed. The subjects presented include: (1) the physical mechanisms of nuclear reactions, (2) relative and absolute standards, (3) total neutron cross sections, (4) neutron scattering cross sections, (5) non-neutron exit channels, and (6) the fission process. Author

N74-11510 Oak Ridge National Lab., Tenn.
THE keV NEUTRON TOTAL CROSS SECTION MEASUREMENTS AT ORELA c24
J. A. Harvey *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1075-1086 refs Sponsored by AEC (For availability see N74-11480 02-22)

The Oak Ridge Electron Linear Accelerator (ORELA) was designed to be optimum for neutron cross section measurements

in the energy region from a few KeV to a few hundred KeV. The time uncertainties in the moderator surrounding the fast-neutron photonuclear source and the flight times for these energy neutrons in reasonable neutron detectors determined the electron burst widths (3 to 30 nanoseconds) from the accelerator for which maximum performance was required. Peak currents of 15 amperes of 140-MeV electrons (corresponding to a peak neutron production rate of 3 times 10 to the 18th power fast neutrons per second during the electron pulse) and a repetition rate of 1000 pps make ORELA one of the best available sources for most types of KeV neutron cross section measurements. For total cross section measurements 3 flight stations at 18, 80 and 200 meters were constructed. Author

N74-11511 Commissariat a l'Energie Atomique, Saclay (France). Dept. de Physique Nucleaire.
FISSION CROSS SECTIONS AND THE FISSION PROCESS c24
Andre Michaudon *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1087-1106 refs (For availability see N74-11480 02-22)

A method for more accurate calculations of the fission barriers, taking into account the effect of shells at all deformations, is discussed. The method provides information of fission isomers and intermediate structure which were unexplained by conventional models. The data are interpreted in terms of double-humped barrier shapes. The conditions are described as: (1) near threshold where vibrational fission resonances can appear, (2) below threshold where intermediate structure can exist, and (3) the presence of the intermediate structure in the fission cross section of fissile nuclei. Author

N74-11512 Rensselaer Polytechnic Inst., Troy, N.Y.
IRON-FILTERED NEUTRON BEAM - A NEW APPROACH TO PRECISION TIME-OF-FLIGHT CROSS SECTION MEASUREMENTS c24
R. C. Block, N. N. Kaushal, and R. W. Hockenbury *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1107-1114 refs (For availability see N74-11480 02-22)
(Contract AT(11-1)-3058)

By placing thick iron filters in a white-source time-of-flight neutron beam, it is possible to obtain a low-background transmitted beam of bands of neutrons with energies corresponding to the cross section minima in the filter. Capture cross section measurements were carried out upon In, Ta, Au, and U-238, near the 24.3 keV energy band, and the integrated capture cross sections are determined. This technique is intrinsically capable of an accuracy in the cross section of 2 to 3 percent. Author

N74-11513 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE-DEPENDENT TRANSMISSION AND SELF-INDICATION MEASUREMENTS UPON DEPLETED U IN THE UNRESOLVED REGION
T. Y. Byoun, R. C. Block, and T. Semler *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1115-1126 refs Prepared in cooperation with Rensselaer Polytechnic Inst. (For availability see N74-11480 02-22)
(Grant NGR-33-018-134)

Neutron transmission and self-indication ratio measurements have been carried out at the RPI LINAC on depleted U up to 100 KeV in order to investigate the temperature dependence of resonance self-shielding. These measurements were performed at three sample temperatures (77 deg k, 295 deg k, and 973 deg k) and with sample thicknesses ranging from 0.0076 to 0.0621 atom/barn. Both stochastic sampling and analytical methods have been used to interpret these data. Average resonance parameters have been obtained and temperature dependence as well as sample thickness dependence of the data have been extensively studied. Author

N74-11514 Brookhaven National Lab., Upton, N.Y. National Neutron Cross Section Center.
THE BASIS OF CURRENT EVALUATED DATA FILES c06
M. K. Drake *In* AEC, Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1127-1151 refs Sponsored by AEC (For availability see N74-11480 02-22)

The ENDF/B Library is intended to provide a reference set of nuclear data for use in nuclear calculations. Each version of the Library is expected to be used and tested for a period of one of two years. The Library is revised only after extensive integral data testing has been done for the various application areas, such as thermal and fast reactor design, shielding and weapons calculations. Deficiencies detected in the integral data testing calculations and information about the availability of new microscopic experimental results are brought to the attention of the CSEWG. CSEWG then recommends that the data sets which contain known deficiencies be totally or partially re-evaluated. The philosophy of CSWG is that the data sets contained in ENDF/B be based on the best microscopic information available which is generally in the form of results from accurate microscopic measurements. Frequently complete experimental results are not available and the evaluator has to supplement the experimental information with results from nuclear systematics or nuclear model calculations. Author

N74-11515 Argonne National Lab., Ill.
THE FAST NEUTRON DOPPLER EFFECT c24
C. E. Till *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1152-1165 refs Sponsored by AEC (For availability see N74-11480 02-22)

The Doppler effects in fast neutron spectra for the elements and isotopes measured to the present time are compiled. The status of fissile Doppler effect measurements and analytical comparisons is summarized. Finally, the Doppler effect of major practical importance, that of U-238, is examined in some detail: U-238 Doppler effect calculations using various versions of ENDF/B data, including Version-III, are compared against measurement. The effects of both assembly and sample heterogeneity are given. Calculations of the effect on the U-238 effect of major changes in reactor composition are compared against measurement. Author

N74-11516 Argonne National Lab., Ill.
SOME RECENT DEVELOPMENTS IN RESONANCE AND DOPPLER THEORY c24
Richard N. Hwang *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1166-1182 refs Sponsored by AEC (For availability see N74-11480 02-22)

Developments in resonance and Doppler theory are presented. The first part describes the newly developed methods for treating the self-shielded cross sections in both the resolved and the unresolved energy regions. The second part describes some recent studies on the statistical treatment of the unresolved resonances. The topics discussed are: (1) the characteristics of the in-sequence overlap effect, (2) the problems associated with the estimation of the statistical uncertainties of the calculated Doppler effect, (3) the influence of the subthreshold structures on the Doppler effect calculations, and (4) theory and application of the multilevel formalism. Author

N74-11517 Stuttgart Univ. (West Germany).
GROUP CONSTANT GENERATION FOR THE RESOLVED RESONANCE REGION
R. Ruehle, D. Emendoerfer, W. Gulden, and D. Lutz *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1183-1191 refs (For availability see N74-11480 02-22)

The computer code RESAB has been developed to analyze group cross section generation in the resolved resonance region. The computer program solves the slowing down Boltzmann equation into micro energy group representation by exact first flight collision probabilities for multi region cells with white cell boundaries. Mathematical models of the numerical analysis are developed. Supporting data represented in tables and graphs. Author

N74-11518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMMENTS ON THE FEASIBILITY OF DEVELOPING GAS CORE NUCLEAR REACTORS
Frank E. Rom 24 Oct. 1969 40 p refs Presented at the Frontiers of Power Technol. Conf., Stillwater, Okla., 23-24 Oct.

1969; sponsored by Okla. State Univ.
(NASA-TM-X-52644) Avail: NTIS HC $4.00 CSCL 18I

Recent developments in the fields of gas core hydrodynamics, heat transfer, and neutronics indicate that gas core nuclear rockets may be feasible from the point of view of basic principles. Based on performance predictions using these results, mission analyses indicate that gas core nuclear rockets may have the potential for reducing the initial weight in orbit of manned interplanetary vehicles by a factor of 5 when compared to the best chemical rocket systems. In addition, there is a potential for reducing total trip times from 450 to 500 days for chemical systems to 250 to 300 days for gas core systems. The possibility of demonstrating the feasibility of gas core nuclear rocket engines by means of a logical series of experiments of increasing difficulty that ends with ground tests of full scale gas core reactors is considered. Author

N74-11519# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-CONTAINED LOW POWER ATOMIC PLANTS
A. M. Petrosyants 27 Aug. 1973 12 p Transl. into ENGLISH from the publ. "Ot Nauchnogo Poiska k Stomnoi Promyshlennosti" USSR, 1972 p 198-203
(AD-766969; FTD-HT-23-702-73) Avail: NTIS CSCL 18/5

The report discusses research in the USSR into the direct conversion of thermal (nuclear) energy into electrical, including thermionic, thermoelectrical, and MHD methods. GRA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-11520 Pennsylvania State Univ., University Park.
ELECTRICAL CONDUCTION AND OPTICAL PROPERTIES OF FERROELECTRIC CRYSTALS Ph.D. Thesis
Joseph Patrick Dougherty 1972 130 p
Avail: Univ. Microfilms Order No. 73-13969

The electrical conductivity and the optical properties of several single crystal ferroelectrics have been investigated in order to gain information on the macroscopic internal electric fields within the materials. The Kerr effect has been demonstrated to be a useful tool with which to investigate the electric field distributions within transparent seim-insulators with large electro-optic coefficients. On the basis of the potential distributions determined by the electro-optic method, a theoretical model was developed which can be used to calculate the static current voltage characteristics for a conducting semi-insulator with blocking contacts. The fields calculated from the theoretical model are in agreement with the experimental results of the electro-optic measurements and the X-ray measurements of surface layers in barium titanate. Dissert Abstr.

N74-11521 Conservatoire National des Arts et Metiers, Paris (France). Inst. National de Metrologie.
GERMANIUM PROBE CALIBRATION AT EXTREMELY LOW TEMPERATURES Final Report [TRES BASSES TEMPERATURES ETALONNAGE DE SONDES AU GERMANIUM]
Andre Moser and Georges Bonnier Nov. 1972 37 p refs In FRENCH
(Contract DGRST-70-02-139)
Avail: Issuing Activity

A highly stabilized cryostat in the range 1.5 to 100 K was built with special emphasis on error analysis. A set of germanium thermometers was calibrated with respect to scale T58 from 1.9 to 4.2 K with a one mK precision. Two thermometers sent to NPL were compared upon return with the temperature scale of the Institut de Metrologie; the differences between the two laboratories do not exceed 1.3 mK. A comparison with Orsay Laboratory yielded a difference of 2 mK. An interpolation method by means of orthogonal polynomials was devised and a polynomial formula to calibrate germanium thermometers to better than 0.4 Mk with respect to the 4 He vapor tension is given. ESRO

N74-11522 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
SPATIAL FREQUENCIES FILTERING AND COHERENT OPTICS POTENTIALITIES Final Report [ETUDE DES POSSIBILITES DU FILTRAGE DES FREQUENCES SPATIALES ET DE L'OPTIQUE COHERENTE]
Broussaud, E. Spitz, F. LeCarvennec, F. Poisson, and M. Rembault Dec. 1972 131 p refs In FRENCH
(Contract DGRST-70-02-184)
(LCR-DR-1-72-133/1/R) Avail: Issuing Activity

Possible techniques in the field of spatial frequency filtering and coherent optics were investigated. A lens with 300 mm focus and 10 mm diameter as well as a matrix of 32 by 32 lenses with 500 micron diameter, were developed. The input of data in an optical correlator with a totally reflecting prism is discussed, with an application to fingerprint processing. The possibility of a dynamic correlator directly acting upon a processed image is investigated, the solution adopted being a liquid crystal display. This feasibility study shows that the utilization of liquid crystals in an optical correlator is possible. ESRO

N74-11523*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC RADIATION PATTERNS FOR A SOURCE IN A HARD-WALLED UNFLANGED CIRCULAR DUCT
Raymond G. Holm Washington Nov. 1973 19 p refs
(NASA-TN-D-7360; L-9025) Avail: NTIS HC $2.75 CSCL 20A

Acoustic radiation patterns are measured over a 320 deg arc for a point source in a finite length, hard walled, unflanged circular duct. The measured results are compared with computed results which are based on the Wiener-Hopf solution for radiation from a semi-infinite unflanged duct. Measurements and computations are presented for frequencies slightly below and slightly above each of the first four higher order radial mode cutoff frequencies. It is found that the computed and measured patterns show better agreement below the mode cut-off frequencies than above and that the agreement is better at lower frequencies that at higher frequencies. The computed radiation patterns do not show fine lobes which are caused by diffraction from the back end of the duct. Author

N74-11524# Houston Univ., Tex. Dept. of Electrical Engineering.
RESEARCH PROGRAMS IN ELECTRO-OPTICS AND OPTICAL COMMUNICATIONS Annual Summary Report, Sep. 1972 - Sep. 1973
Richard C. Simpson 1 Sep. 1973 8 p
(Contract N00014-72-C-0085)
(AD-766957) Avail: NTIS CSCL 20/6

The report mentions research programs in the use of optical techniques in such diverse areas as biomedical science, health care, digital communication, and remote sensing. GRA

N74-11525# Naval Electronics Lab. Center, San Diego, Calif.
FIBER OPTIC CABLE TEST Evaluation Report, Feb. - Oct. 1972
Robert L. Lebduska 12 Mar. 1973 90 p
(NELC Proj. Z242; ZF61212001)
(AD-767017; NELC-TR-1869) Avail: NTIS CSCL 20/6

Over 200 plastic-jacketed, incoherent, fiber-optic cables, primarily Corhing Glass Works types 5010 and 5011, are subjected to 29 different environmental and physical property tests. The tests were specified to evaluate cable performance within the chosen Naval Equipment Category of shipboard and shore equipment with air-transportability capability. Cable property definitions are obtained for bend radius; tensile, terminal, and mandrel strengths; twist; flexure; vibration; shock; and thermal, humidity, and various chemical exposures. Also, a number of original diagnostic methods are developed to assist in evaluating the test-induced capble optical modifications. Test results are found to indicate that these cable types exhibit properties capable of performing within the chosen category and that practical harnesses for certain Navy applications can be readily fabricated. Recommendations are made for future improvement and quality control of these type cables. Author (GRA)

N74-11526# Maryland Univ., College Park. Dept of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS Quarterly Technical Report, 22 Mar. - 21 Jun. 1973
Chi H. Lee and Vutthi Bhanthumnavin 26 Jul. 1973 150 p refs
(Grant DA-ARO(D)-31-124-72-G82; ARPA Order 675)
(AD-766779; TR-014) Avail: NTIS CSCL 20/6

The intensity of the second harmonic light in total reflection and in transmission from uniaxial KDP crystals immersed in an optically denser liquid l-bromonaphthalene have been measured as a function of angle of incidence of the fundamental beam from a mode locked Nd:glass laser. The results agreed well with the theoretical predictions of theory given by Bloembergen and Pershan. In particular, the existence of a Nonlinear Brewster's angle of a transparent medium (KDP), with nonlinear polarization in the plane of reflection, has been first demonstrated. The transmitted second harmonic intensity under noncollinear phase matched condition by means of two beam spatial mixing (TBSM) in the KDP crystal, using Q-switched Nd:glass laser pulses, was observed as a function of the angle of incidence. The result was in good agreement with the theory of Bloembergen and Pershan. As a consequence, this result was used to measure the second order intensity auto-correlation function of Nd:glass laser radiation. Author (GRA)

N74-11527# Martin Marietta Corp., Orlando, Fla.
ACOUSTO-OPTIC ISOLATOR (AOI) Final Report, 16 Jun. - 15 Dec. 1972
Vincent J. Corcoran, William T. Smith, and James M. Martin Sep. 1973 105 p refs
(Contract F30602-72-C-0475)
(AD-766749; OR-12348; RADC-TR-73-245) Avail: NTIS CSCL 20/6

Coherent CO2 radars having amplification stages following a CO2 master oscillator exhibit spurious feedback which tends to pull the frequency of the signal. The acousto-optic isolator (AOI) concept has shown promise to correct the feedback problem. Under this program, a number of AOI devices have been constructed, tested, and compared. Using a master oscillator/power amplifier simulator, instability of the master oscillator has been determined to be a function of feedback level, the difference between feedback signal and oscillator frequencies, and averaging time. AOI devices are shown to enhance the stability of the master oscillator. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-11528 Wisconsin Univ., Madison.
THERMAL DIFFUSE SCATTERING OF LOW-ENERGY ELECTRONS AT LOW TEMPERATURES Ph.D. Thesis
Robin Leroy Dennis 1972 130 p
Avail: Univ. Microfilms Order No. 73-9196

The construction of a very precise cryogenic low-energy electron diffractometer is reported and its use in detailed measurements of the thermal diffuse scattering from the (111) surface of silver is described. Thermal diffuse scattering was measured across the entire Brillouin zone at various energies and temperatures from 40 to 820 deg K. Using its measured temperature dependence, the scattered intensity was separated into its zero-, one-, and multiphonon components so that one can follow the one phonon scattering all the way to the Brillouin zone boundary. The observed deviations from the results expected for a continuum model due to the phonon dispersion in the vicinity of the surface are in accord with qualitative expectations. Dissert. Abstr.

N74-11529# Lund Univ. (Sweden). Dept. of Physics.
THE VELOCITY DEPENDENCE OF THE PHOTOMETRICALLY DETERMINED TRACK WIDTH OF HEAVY IONS IN ILFORD G5 NUCLEAR EMULSIONS
L. Larsson, R. Andersson, and O. Mathiesen Jun. 1973 19 p refs Sponsored in part by Swed. Atomic Res. Council and Swed. Nat. Sci. Res. Council
(LUIP-CR-73-08) Avail: NTIS HC $3.00

The relation between the photometrically determined track width, W, and the velocity beta of some heavy ions with charge numbers Z = 14, 16, 24, and 26 was established in Ilford G5 nuclear research emulsions. It was found that in the velocity interval 0.4 less than or equal to beta less than or equal to 0.8, the relation between W, Z, and beta can approximately be written W(beta,Z) equals Wo(Z) beta to the minus alpha(Z) power. The numerical value of alpha(Z) is about one. From the empirical function W(beta,Z) the rate of change of W was derived along the track. Author (ESRO)

N74-11530# Lund Univ. (Sweden). Dept. of Physics.
ANALYSIS OF PHOTOMETRIC MEASUREMENTS OF TRACKS PRODUCED BY HEAVY COSMIC RAY PARTICLES STOPPING IN A STACK OF NUCLEAR EMULSIONS
S. Behrnetz, K. Kristiansson, S. Lindstam, and K. Soederstroem Jan. 1973 55 p refs Sponsored by Swed. Atomic Res. Council
(LUIP-CR-73-01) Avail: NTIS HC $4.75

The photometric technique was applied to identify heavy cosmic ray nuclei stopping in nuclear emulsions. The chemical composition of the primary cosmic radiation for the elements from silicon to iron in the energy range from 400 to 800 MeV/nucleon was measured using data on heavy primary tracks registered in a stack of nuclear emulsions during upper atmosphere balloon sounding over northern Canada. The photometer data was corrected for different measuring and emulsion effects, and 156 particles were selected for a charge spectrum. The standard deviation of the charge determinations amounts to 0.2 units of charge for silicon and 0.3 units for iron. Relative abundances are given for the elements silicon to nickel. The experimental details and the reduction of the photometer data are given. Author (ESRO)

N74-11531# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
IONIZATION AND ATTRACTION OF NEUTRAL MOLECULES TO A CHARGED SPACECRAFT Report for Sep. 1972 - Feb. 1973
David P. Cauffman 9 Aug. 1973 35 p refs
(Contract F04701-73-C-0074)
(AD-766410; TR-0074(9260-09)-1; SAMSO-TR-73-263) Avail: NTIS CSCL 07/4

Neutral molecules given off by spacecraft outgassing or thrusters may become ionized by solar uv radiation or ambient energetic electrons. These ions may be reattracted to the spacecraft and hence constitute a source of contamination for sensitive spacecraft surfaces. In this report, the magnitude of this effect is calculated. Using the best available outgas fluxes, it is predicted that the reattraction of outgas products will be a large contaminating effect during the initial several months of the spacecraft's orbital lifetime. The implications of assuming that this contamination mechanism is the dominant one during the early spacecraft lifetime are examined. In addition, a list of parameters that need to be measured more accurately is presented, and ways to combat contamination from this source are outlined. (Modified author abstract) GRA

N74-11532# Stanford Univ., Calif. Dept. of Physics.
QUANTUM PROPERTIES OF FLUIDS AND SOLIDS, PHYSICS AND INTERACTING PARTICLES AND FIELDS Final Report
John Dirk Walecka and Alexander L. Fetter Aug. 1973 32 p refs
(Contract F44620-71-C-0044; AF Proj. 9767)
(AD-766923; AFOSR-73-1629TR) Avail: NTIS CSCL 20/8

A summary of research progress and activities is reported in these areas: (1) intermediate physics, including semil-leptonic weak and electromagnetic interactions with nuclei, the optical model, and multiple scattering expansions; (2) low temperature physics, including liquid helium, absorbed helium, and charged Bose gas many-electron systems; (3) many body theory,

including interacting Fermi systems, and Greens's function treatment of many body systems at high temperature; and (4) high energy physics, including field theory, weak interactions, and electroproduction. A list of publications is included.
Author (GRA)

N74-11444 Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ENERGY DEPENDENT CROSS SECTIONS IN THE THERMAL REGION
B. R. Leonard, Jr. *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 81-96 refs (For availability see N74-11438 02-22)
(Contract AT(45-1)-1830)

N74-11446 Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
THE EFFECT OF PARTICLE SIZE ON RESONANCE CAPTURE
Rubin Goldstein *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 108-113 refs (For availability see N74-11438 02-22)

N74-11448 Argonne National Lab., Ill.
ADVANCES IN NEUTRON CONTINUOUS SLOWING DOWN THEORY
Weston M. Stacey, Jr. *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 143-161 refs Sponsored by AEC (For availability see N74-11438 02-22)

N74-11451 Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
GREEN'S FUNCTION COUPLING METHOD FOR TIME DEPENDENT NEUTRON SLOWING DOWN IN HEAVY MEDIA
Robert Conn and Mohamed Sawan *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 179-194 refs (For availability see N74-11438 02-22)

N74-11452 Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh. Nuclear Research Center.
A MANY RESONANCE APPROXIMATION FOR THE NEUTRON ENERGY SPECTRUM
M. Segev *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 195-206 refs (For availability see N74-11438 02-22)

N74-11453 California Univ., Berkeley. Dept. of Nuclear Engineering.
PREDETERMINING STATISTICAL ERRORS IN MONTE CARLO TRANSPORT CALCULATIONS
Harvey J. Amster *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 207-210 refs (For availability see N74-11438 02-22)

N74-11457 Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SIMULTANEOUS LINE OVER-RELAXATION (SLOR) IN HEXAGONAL LATTICE
H. C. Honeck and J. W. Stewart *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 253-265 refs (For availability see N74-11438 02-22)
(Contract AT(07-2)-1)

N74-11458 McMaster Univ., Hamilton (Ontario). Dept. of Engineering Physics.
OPTIMUM ANGULAR SEGMENTATIONS IN NEUTRON TRANSPORT ANALYSIS
A. A. Harms and W. J. Garland *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 266-274 refs (For availability see N74-11438 02-22)

N74-11459 Assistant Secretary of Defense (Systems Analysis), Washington, D.C.
AN IMPROVED S(N) INNER ITERATION CONVERGENCE CRITERION
Gerald L. Atkinson, William Kerr (Mich. Univ., Ann Arbor), and James J. Duderstadt (Mich. Univ., Ann Arbor) *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 275-292 refs (For availability see N74-11438 02-22)

N74-11462 Oak Ridge National Lab., Tenn.
SECONDARY GAMMA-RAY-PRODUCTION CROSS SECTIONS OF SEVERAL MATERIALS
G. L. Morgan, J. K. Dickens, T. A. Love, and F. G. Perey *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 325-334 refs Sponsored by AEC and DNA (For availability see N74-11438 02-22)

N74-11463 Columbia Univ., New York.
THE MECHANISM OF FAST NEUTRON TRANSPORT IN IRON
H. Goldstein, E. Oblow, W. Preeg, J. Ching, E. Troubetzkoy, and L. J. Lidofsky *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 335-348 refs (For availability see N74-11438 02-22)
(Contracts AT(30-1)-73; ORNL-3114)

N74-11466 Columbia Univ., New York.
THE CARBON SHIELDING BENCHMARK PROBLEM AND OTHER NEUTRON TRANSPORT CALCULATIONS IN CARBON
H. Goldstein, P. D. Soran, and C. R. Weisbin *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 397-408 refs (For availability see N74-11438 02-22)
(Contract AT(30-1)-GEN-72)

N74-11467 Los Alamos Scientific Lab., N.Mex.
SENSITIVITY OF CALCULATED PULSED SPHERE SPECTRA AND NEUTRON AGE TO CARBON CROSS SECTIONS
C. R. Weisbin, R. E. Seamon, D. R. Harris, L. Stewart, R. J. LaBauve, and G. D. Turner *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 409-417 refs Sponsored by AEC (For availability see N74-11438 02-22)

N74-11468 Oak Ridge National Lab., Tenn.
THE ORNL SODIUM BENCHMARK EXPERIMENT
R. E. Maerker, F. J. Muckenthaler, and C. E. Clifford *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 418-430 refs (For availability see N74-11438 02-22)
(Contract W-7405-eng-26)

N74-11474 Science Applications, Inc., El Segundo, Calif.
DOMINO: A GENERAL PURPOSE DISCRETE ORDINATES TO MONTE CARLO COUPLING CODE FOR RADIATION TRANSPORT
C. E. Burgart, M. B. Emmett, and T. J. Hoffman *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 499-511 refs Prepared in cooperation with Oak Ridge Nat. Lab., Tenn. (For availability see N74-11438 02-22)

N74-11475 Oak Ridge National Lab., Tenn.
SENSITIVITY ANALYSIS: A GENERAL APPROACH ILLUSTRATED FOR A Na-Fe SYSTEM
D. E. Bartine, E. Oblow, and F. R. Mynatt *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 512-523 refs Sponsored by AEC (For availability see N74-11438 02-22)

N74-11476 Kansas State Univ., Manhattan. Nuclear Engineering Dept.
CRITICAL COMPARISON AND EVALUATION OF NEUTRON SPECTRUM UNFOLDING CODES: THE NEED TO KNOW
W. Meyer and G. A. Mutone *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 1 1972 p 524-540 refs (For availability see N74-11438 02-22)

N74-11482 Aktiebolaget Atomenergi, Studsvik (Sweden).
USE OF DATA FROM FAST ASSEMBLIES FOR ADJUSTMENTS OF NEUTRON DATA
H. Haeggblom *In* AEC Natl. Topical Meeting on New Develop.

in Reactor Phys. and Shielding, Book 2 · 1972 p 599-612 refs (For availability see N74-11480 02-22)

N74-11483 Aerojet Nuclear Co., Idaho Falls, Idaho.
THE USE OF CFRMF INTEGRAL DATA IN CROSS SECTION EVALUATIONS
Y. D. Harker and E. H. Turk *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 613-622 refs (For availability see N74-11480 02-22)
(Contract AT(10-1)-1375)

N74-11488 Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
MEASUREMENTS OF DELAYED FISSION NEUTRON SPECTRA OF U-235, U-238 AND Pu-239 WITH PROTON RECOIL PROPORTIONAL COUNTERS
G. Fieg *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 · 1972 p 687-699 refs (For availability see N74-11480 02-22)

N74-11499 Argonne National Lab., Ill.
EBR-II IRRADIATION PHYSICS
D. Meneghetti and W. B. Loewenstein *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 905-927 refs (For availability see N74-11480 02-22)

N74-11510 Oak Ridge National Lab., Tenn.
THE keV NEUTRON TOTAL CROSS SECTION MEASUREMENTS AT ORELA
J. A. Harvey *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1075-1086 refs Sponsored by AEC (For availability see N74-11480 02-22)

N74-11511 Commissariat a l'Energie Atomique, Saclay (France). Dept. de Physique Nucleaire.
FISSION CROSS SECTIONS AND THE FISSION PROCESS
Andre Michaudon *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1087-1106 refs (For availability see N74-11480 02-22)

N74-11512 Rensselaer Polytechnic Inst., Troy, N.Y.
IRON-FILTERED NEUTRON BEAM - A NEW APPROACH TO PRECISION TIME-OF-FLIGHT CROSS SECTION MEASUREMENTS
R. C. Block, N. N. Kaushal, and R. W. Hockenbury *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 · 1972 p 1107-1114 refs (For availability see N74-11480 02-22)
(Contract AT(11-1)-3058)

N74-11515 Argonne National Lab., Ill.
THE FAST NEUTRON DOPPLER EFFECT
C. E. Till *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1152-1165 refs Sponsored by AEC (For availability see N74-11480 02-22)

N74-11516 Argonne National Lab., Ill.
SOME RECENT DEVELOPMENTS IN RESONANCE AND DOPPLER THEORY
Richard N. Hwang *In* AEC Natl. Topical Meeting on New Develop. in Reactor Phys. and Shielding, Book 2 1972 p 1166-1182 refs Sponsored by AEC (For availability see N74-11480 02-22)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-11533 California Inst. of Tech., Pasadena.
NONLINEAR MAGNETOHYDRODYNAMIC PHENOMENA Ph.D. Thesis
Alan Anderson Wray 1973 209 p
Avail: Univ. Microfilms Order No. 73-14321
Assumptions relevant to astrophysical problems are used to derive the isentropic MHD equations. The equations of the characteristic surfaces and the characteristic equations are then derived, from which an exact, compressionless solution is obtained. Time periodic solutions to quasilinear systems are shown to exist only in special cases. The form of linearized MHD waves is derived. The power series recursion relations for MHD are obtained and used to look at early nonlinear behavior in the initial value problem. Various stability and accuracy results for some finite difference schemes are derived, and the schemes are compared by their use on the MHD system. Dissert. Abstr.

N74-11534 Stanford Univ., Calif.
LINEAR AND NONLINEAR STABILITY CHARACTERISTICS OF WHISTLERS Ph.D. Thesis
Armando Larcher Brinca 1973 176 p
Avail: Univ. Microfilms Order No. 73-14869
Certain linear and nonlinear propagation characteristics of the right-hand polarized, slow electromagnetic, magnetoplasma waves known as whistlers are analized and the results are applied to conditions prevailing in the equatorial magnetosphere, i.e., to an effectively cold magnetoplasma permeated by a dilute non-thermal electron population with variable energy and pitch angle. The linear studies treat whistlers with wavenormals parallel and oblique to the static magnetic field. For parallel propagation in a hot plasma with an arbitrary equilibrium velocity distribution, a stability criterion differentiating between absolute and convective instabilities is established by studying the asymptotic response of the system to impulse excitation. A discussion of true and pseudo-modes defined by the dispersion relation is given for the special case of resonance velocity distributions.
Dissert. Abstr.

N74-11535 North Carolina State Univ., Raleigh.
SURFACE INTERACTIONS IN A PLASMA DIODE Ph.D. Thesis
Siou-Ming Chu 1972 70 p
Avail. Univ. Microfilms Order No. 73-13908
Surface effects on sheath structures in a plasma diode are studied. Analysis of such a problem requires the simultaneous solution of the Boltzmann equations for ions, electrons and neutrals, and Poisson's equation, and appropriate boundary conditions. Due to the difficulties involved in solving integro-differential equations, the collisional integrals were approximated by modified Krook's models and the Boltzmann equations were solved by using Lees' moment method. The resulting two point boundary value problem is then solved by an iteration procedure with a fourth order Runge-Kutta method. Dissert. Abstr.

N74-11536 Stanford Univ., Calif.
LOW-FREQUENCY MACROSCOPIC INSTABILITIES OF A FULLY IONIZED MAGNETOPLASMA Ph.D. Thesis
Thomas Dale Rognlien 1973 200 p
Avail: Univ. Microfilms Order No. 73-14968
A series of studies are described of low-frequency quasistatic instabilities in a fully ionized plasma. The plasma is assumed to be immersed in a uniform magnetic field, and is either uniform or has a number density gradient perpendicular to the magnetic field. A moment equation description of the ion and electron dynamics is used. Before considering specific modes, a stability analysis is developed which allows a classification of wave growth characteristics to be made for a bounded system from solutions to the dispersion relation for an infinite system. For wave propagation perpendicular to the magnetic field, the flute wave is studied in cylindrical geometry. For propagation at an angle to the magnetic field, resistive drift waves driven unstable by a density gradient are considered in rectangular geometry. For propagation parallel to the magnetic field, the stability of ion-acoustic waves is studied. Dissert. Abstr.

N74-11537# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
MAGNETOFLUIDDYNAMICS [BERICHT UEBER DIE SITZUNG DES DGLR-FACHAUSSCHUSSES MAGNETOFLUIDDYNAMIK]
May 1973 161 p refs In GERMAN; ENGLISH summary Proc. of the DGLR Symp. held at Stuttgart, 21 Sep. 1972
(DLR-Mitt-73-15) Avail: NTIS HC $10.25; ZLDI, Munich 33,85 DM

Magnetohydrodynamic generators and the characteristics of plasma accelerators are studied with emphasis on combustion physics. For individual titles, see N74-11538 through N74-11544.

N74-11538 Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
SOME EXPERIMENTAL AND THEORETICAL RESULTS OF THE IPP-MAN COMBUSTION MHD GENERATOR [EINIGE EXPERIMENTELLE UND THEORETISCHE ERGEBNISSE AM IPP-MAN VERBRENNUNGS-MHD-GENERATOR]
G. Zankl, J. Raeder, and R. Buende *In* DGLR Magnetofluiddyn. May 1973 p 7-18 refs In GERMAN (For availability see N74-11537 02-25)

Some experimental and theoretical results for the combustion MHD generator are reported. The generator is based on combustion of kerosene or benzol together with potassium octoate to provide the combustion plasma. The combustion gases are expanded in a supersonic nozzle perpendicular to a magnetic field to provide an output energy of 10 MW. The effects of electrode losses and combustion efficiency on performance are pointed out. Further problems, such as fluctuation in the combustion system and MHD channel, are discussed. ESRO

N74-11539 Studiengruppe Ballistik Schrobenhausen (West Germany).
INVESTIGATIONS ON EXPLOSIVE-DRIVEN MHD GENERATORS [UNTERSUCHUNGEN UEBER SPRENGSTOFF-BETRIEBENE MHD-GENERATOREN]
E. H. Jager and F. R. Thomanek *In* DGLR Magnetofluiddyn. May 1973 p 19-34 refs In GERMAN (For availability see N74-11537 02-25)

The possibility of using explosions to drive MHD generators is discussed, and some experiments are reported. Two means of application were investigated. These are based on either the flow of expanding detonation products, which are highly ionized gases, or the forward flow in the detonation zone itself. In the first case, the explosive is injected with an easily ionizable material (e.g. cesium), in the second, with a high permeability material. These combinations were tested for rectangular geometry and cylinder geometry of the generator. ESRO

N74-11540 Duesseldorf Univ. (West Germany). Inst. fuer Experimentalphysik II.
PERTURBATIONS OF THERMODYNAMIC EQUILIBRIUM BY ENERGY FLOW IN LOW PRESSURE PLASMAS [STOERUNGEN DES THERMODYNAMISCHEN GLEICHGEWICHTS DURCH ENERGIETRANSPORT IN NIEDERDRUCKPLASMEN]
J. Hackmann and J. Uhlenbusch *In* DGLR Magnetofluiddyn. May 1973 p 35-47 refs In GERMAN (For availability see N74-11537 02-25)

The effects of a strongly directed heat flow on the thermodynamic equilibrium of a plasma are discussed. A plasma is considered for which the directed energy flow is of the order of magnitude of the isotropic thermal energy flow. Such relations can be found in the wall zone of a fusion reactor or in a wall-stabilized low pressure arc discharge. The phenomenon is illustrated by calculations for solid spheres, and measurements of deuterium plasmas, and helium discharges. ESRO

N74-11541 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
GENERATION OF HYPERSONIC MOLECULAR FLOW WITH HIGH STAGNATION TEMPERATURE BY MEANS OF AN INDUCTION PLASMA TORCH [UEBER DIE ERZEUGUNG HOHER RUHETEMPERATUREN FUER MOLEKULARE HYPERSONISCHE STROEMUNGEN MITTELS EINES INDUKTIONS-PLASMA-BRENNERS]
H. Mueller *In* DGLR Magnetofluiddyn. May 1973 p 49-74 refs In GERMAN; ENGLISH summary (For availability see N74-11537 02-25)

To generate a molecular hypersonic flow with high stagnation temperature the flow is heated in an induction plasma torch before expansion into vacuum. The conditions for argon, helium and nitrogen for low stagnation pressures and small mass flows are investigated. The energy is transferred to the induction plasma torch by a 12 kW RF-generator using a frequency of 7.7 MHz. The energy coupling to the plasma is investigated and described by a simplified model. The stagnation temperature before the nozzle is obtained by using expressions for the one dimensional, isentropic expansion including Reynolds number dependent boundary layer effects. Author (ESRO)

N74-11542 Technischen Universitaet, Munich (West Germany). Inst. fuer Raumfahrttechnik.
MAGNETOGASDYNAMIC PLASMA COMPRESSION FOR PARTICLE ACCELERATION FOR THE SIMULATION OF MICROMETEOROIDS [MAGNETOGASDYNAMISCHE KOMPRESSION EINES PLASMAS ZUR BESCHLEUNIGUNG VON TEILCHEN FUER DIE SIMULATION VON MIKROMETEORIDEN] **c11**
Eduard Igenbergs *In* DGLR Magnetofluiddyn. May 1973 p 75-122 refs In GERMAN (For availability see N74-11537 02-25)

A compression coil was developed in order to obtain a compressed flow of plasma from a coaxial plasma generator without reducing the flow velocity. The same discharge, which accelerates the plasma in the coaxial part, supplies the energy to the coil. Several experiments have shown the feasibility of this set-up, and a theory has been developed to describe the phenomena. This equipment can be used for micrometeoroid simulation. ESRO

N74-11543* Princeton Univ., N.J.
ENERGY DISTRIBUTION IN PARALLEL PLATE PLASMA ACCELERATORS [LEISTUNGSAUFTEILUNG IN PARALLELPLATTENPLASMABESCHLEUNIGERN]
Marco S. DiCapua (Stuttgart Univ.) *In* DGLR Magnetofluiddyn. May 1973 p 123-147 refs In GERMAN; ENGLISH summary (For availability see N74-11537 02-25)
(Grant NGL-31-001-005)

A parallel plate accelerator operated in the quasi-steady regime of argon mass flow discharges permits, on account of its geometry, the appraisal of the initial ratio of energy disposition into the kinetic and thermal modes of the plasma while retaining the essential features of coaxial high power self-field MPD accelerators. The energy disposition ratio, calculated as the ratio of kinetic energy to enthalpy in the exhaust flow, shows reasonable agreement with the ratio of the induced emf in the accelerator to resistive voltage drop. Both these ratios indicate that the discharge imparts more energy to the flow by resistive heating than by direct body force acceleration. This is turn suggests that other acceleration mechanisms must be responsible for the high performance of conventional MPD arcs. Author (ESRO)

N74-11544 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Plasmadynamik.
RADIAL FORCE EFFECT ON AN ARC DISCHARGE BURNING BETWEEN COAXIAL ELECTRODES [BEEINFLUSSUNG EINER ZWISCHEN KOAXIALEN ELEKTRODEN BRENNENDEN, STARK ANGEBLASENEN LICHTBOGENENTLADUNG DURCH RADIALE KRAEFTE]
H. Huegel *In* DGLR Magnetofluiddyn. May 1973 p 149-161 refs In GERMAN (For availability see N74-11537 02-25)

Theoretical and experimental investigations were carried out on coaxial plasma accelerators to assess the effects of increasing current density. It was found that the current density for constant mass flow cannot be increased at random if a steady arc discharge with a diffuse anodic electrode coverage is to be maintained. For high argon currents, a large increase of the field strength near the anode was found, resulting in a change into an unsteady discharge with anode spot formation. ESRO

N74-11545# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
ANNUAL STATUS REPORT, 31 DECEMBER 1972
Dec. 1972 63 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
Avail: NTIS HC $5.25

Work done during 1972 by the Experimental, Theoretical and Technology/Engineering Divisions is reviewed. This includes plasma pinch and confinement within a gas blanket, turbulent heating of plasmas, Alcator experiment, wave propagation,

instabilities, and particle motion near cyclotron resonances.
ESRO

N74-11546# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
THE HEATING OF A TOKAMAK PLASMA TO IGNITION TEMPERATURES BY CURRENT-DRIVEN TURBULENCE
H. DeKluiver Mar. 1973 9 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-73-76) Avail: NTIS HC $3.00

The possibility of heating a plasma in a Tokamak-type toroidal machine to ignition temperatures by means of strong turbulence induced by strong currents is investigated. By strong turbulence is meant the excitation and subsequent thermalization of nonlinear acoustic and electron plasma waves which arise when the electron drift velocity exceeds the ion-acoustic velocity by the action of high electric fields parallel to the toroidal magnetic field. ESRO

N74-11547# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
PROPOSAL FOR PREFERENTIAL SUPPORT. PROJECT: TURBULENT HEATING OF A TOROIDALLY CONFINED PLASMA BY HIGH ELECTRIC FIELDS
H. W. Piekaar, B. DeGroot, and H. DeKluiver Mar. 1973 15 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-73-75) Avail: NTIS HC $3.00

A proposal was made to turbulently heat a toroidal plasma of 10 to the nineteenth power to 10 to the twentieth power/cu m by inducing strong electric fields during 1 microsecond. The plasma will be created by discharging a slow capacitor bank in the copper shell surrounding the quartz torous and will be contained by a toroidal magnetic field of 2 Tesla. Strong magnetic fields are acheived by connecting a capacitor bank charged up to 50 kV at four gaps in the copper shell. In this way the actual voltage on the plasma may be four times larger than without such sectioning. When the plasma is heated sufficiently the bank will be crowbarred with a metal-to-metal switch. It was calculated that the inductances are such that the plasma current will flow for at least 100 microsec. The heating efficiency, the ion and electron temperatures, the plasma resistivity, and the radial current distribution as a function of time was emphasized.
Author (ESRO)

N74-11548# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
PRODUCTION AND MEASUREMENT OF INTENSE ION BEAMS AND BEAM-PRODUCED PLASMA IN A CUSPED MAGNETIC FIELD Ph.D. Thesis - Utrecht Univ.
W. Huizenga Mar. 1972 85 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-72-68) Avail: NTIS HC $6.25

Experimental work on the production and current measurement of intense hydrogen ion beams in pulsed condition (60 mA at 20 kV) is reported. A duoplasmatron provided with a plasma expansion cup at anode potential was used as a source. Results obtained with various configuration of grids mounted in the ion extraction region were compared. Special attention was paid to the beam composition. The formation of plasma by injection of a 20-keV hydrogen ion beam into a quadrupole magnetic containment device is also dealt with. Electron density measurements were made with a 9-mm microwave interferometer and with resonance shift methods using the metallic vessel as a cavity. Current measurements were made with collectors located in the mirror regions. The plasma density in the steady state appears to be proportional to the gas pressure in the range up to 0.0001 Torr. Under normal conditions, the observed plasma-ion temperature is about 150 eV at low gas pressure whereas the electron temperature does not exceed a few eV. The energy transfer from the hot ion component to the plasma is in the order of one part per thousand. Author (ESRO)

N74-11549# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
RECONSTRUCTION OF THE SCREW PINCH DEVICE SP 3
R. J. J. VanHeijningen and A. C. Griffioen Apr. 1972 28 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-72-69) Avail: NTIS HC $3.50

A rapid decay of the toroidal plasma current was observed, which eventually destroys the applied magnetic configuration. Since the loss of the poloidal magnetic flux is i.a. strongly dependent on the interaction of the plasma with the torus wall a beneficial effect is to be expected from an improvement of the magnetic screening. Furthermore, the conservation of the poloidal flux within the plasma can be improved by a closely fitting shield around the torus, together with a suitable design of the primary toroidal circuit. To study the influence of these effects on the decay of the toroidal plasma current the existing screw pinch device SP 3 was reconstructed with an improved torus, a better magnetic screening, and a low inductance primary toroidal circuit. The torus protections and structure, primary circuits radial and azimuthal, additional circuits and control, together with commissioning results, are detailed.
Author (ESRO)

N74-11550# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
CHARGED PARTICLE MOTION NEAR CYCLOTRON RESONANCE Ph.D. Thesis Tech. Univ. Eindhoven
T. J. Schep Dec. 1972 98 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-72-73) Avail: NTIS HC $7.00

A description is given of the motion of a charged particle in the combination of a high frequency electromagnetic wave of large amplitude, and of a (primary) magnetic field that may weakly depend on space and time. The relativistic and nonlinear equations of motion are formulated for a charged particle when the primary field is axially symmetric, while the additional high frequency wave propagates in the direction of the axis of symmetry. The WKB approximation for the transverse motion is derived and discussed. The possible modes of oscillation are discussed. The problem of the motion of a charged particle when the primary field varies only slowly is dealt with. Successive higher order corrections to the WKB approximation are constructed; these corrections prove correct up to increasing powers of a proper smallness parameter, and thus lead to an asymptotic solution of the equation. The related problem of the adiabatic invariant associated with the Helmholtz equation is also considered.
Author (ESRO)

N74-11551# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
DESIGN AND FEASIBILITY TEST OF THE 90 DEG THOMSON-SCATTERING EXPERIMENT FOR SPICA
G. D. Khoe, F. C. Jahoda (Los Alamos Sci. Lab., N. Mex.), C. J. Barth, and H. J. M. Aarts Jul. 1973 13 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-73-77) Avail: NTIS HC $3.00

A position scanning Thomson scattering experiment using a q switched ruby laser and a 10 channel polychromator to measure local electron temperatures and densities of SPICA is presented. The polychromator is a one meter grating spectrometer with dispersion 8.2A/mm. A 40 channel fiber optic arrangement is coupled to 10 photomultiplier tubes. Temperatures in the range from 10 to 1000 eV can be resolved. The problem of stray light reduction is detailed and simulation is performed with Rayleigh scattering by N2 on a dummy SPICA 1/8 scale model. Alignment procedures are adapted to the SPICA set up. A comparison with earlier probe measurement and microwave interferometer at two mm was performed. Results show a good correlation with probe measurements. ESRO

N74-11552# Siemens-Werke, Berlin (Germany). Lab. fuer Technische Physik.
INVESTIGATIONS ON THE INTERACTION BETWEEN ARCS AND GAS FLOW [UNTERSUCHUNGEN UEBER DIE WECHSELWIRKUNG ZWISCHEN HOCHSTROMPLASMEN UND GASSTROEMUNGEN IN HOCHLEISTUNGSSCHALTERN]
Karl Zueckler, H. Topplin, H. Naecke, R. Patzelt, and K. P. Rolff Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1973 75 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-09) Avail: NTIS HC $5. $5.75; ZLDI, Munich 15,75 DM

Model circuit breaker experiments were carried out to investigate the relationship between gas flow and arc behavior in the current zero-region. Synthetic circuits were used for the electrical tests. The optical investigations were carried out by the aid of a schlieren-apparatus with a high speed camera. The existence of plasma jets, which carry metal particles in the region between the contacts, was demonstrated. The behavior of the insulation material in the proximity of the arc was investigated and a suitable test method was worked out. It was possible to improve the mathematical description of the dynamic arc-behavior by a completion of the equation of Mayr. Author (ESRO)

N74-11553# Battelle Columbus Labs., Ohio.
LABORATORY OBSERVATIONS ON ELECTROMAGNETIC SCATTERING FROM PLASMA INSTABILITIES
T. Kaliszewski Jul. 1973 51 p refs
(Grant AF-AFOSR-2335-72)
(AD-766959; AFOSR-73-1593TR) Avail: NTIS CSCL 20/9

Laboratory observations were made of electromagnetic scattering from low pressure, low current dc discharges to test the assertion that low-frequency ion-acoustic waves can be observed and used for the simulation of naturally occurring instabilities. An analysis of the experimental parameters and circumstances shows that such waves should be observable, provided it is permissible to ignore the effect of collisions. Observations of the backscatter signal at X-band from nitrogen and helium discharges indicate that this is, indeed, the case. Large enhancements in the scattering cross sections, relative to the Thomson level, are observed as well as the Doppler spread and lines. The interpretation of the latter is generally consistent with the model of ion-acoustic waves being viewed by an uncollimated antenna. Author (GRA)

N74-11554*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
REFLECTION OF BACKGROUND IONS BY AN EXPANDING LASER PRODUCED PLASMA
Robert R. Goforth and David W. Koopman Apr. 1973 60 p refs
(Grant NGR-21-002-008; Contract AT(40-1)-3819; Grant AF-AFOSR-2225-72; AF Proj. 9751)
(AD-766893; BN-763; AFOSR-73-1592TR; NASA-CR-136006) Avail: NTIS HC $5.00 CSCL 20/9

A mass-spectroscopic study of a precursor feature, which propagates ahead of a laser-produced plasma expanding into a partially ionized background, has confirmed that the feature comprises fast ions of the background gas species. The maximum velocity of the precursor ions is found to be V(MAX) about + or - 2 mu/M (V sub LE), where mu/M is the ratio of reduced mass to background ion mass and (V sub LE is the leading edge velocity of the laser-produced plasma; the precursor ions therefore appear to result from two-body collisions. A theoretical model which includes screened-nuclear cross-sections and friction due to multiple small-angle collisions indicates that hard-knock ion-ion collisions are insufficient to explain the large precursor ion flux which is experimentally observed. The experimental results are in satisfactory agreement with a model which invokes ion-neutral rearrangement collisions for generation of the precursor ions. Author (GRA)

N74-11555# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
A STUDY OF BEHAVIOR AND PROPERTIES OF A PLASMA UNDER CONDITIONS OF RAPID HEATING Final Report, 1 Sep. 1963 - 31 Aug. 1969
Donald E. Kerr May 1973 11 p refs
(Contract Nonr-4010(10); NR Proj. 012-304)
(AD-766831) Avail: NTIS CSCL 20/9

Investigations of the properties of a small linear electromagnetic shock tube reveal the following: At pressures of about 1 Torr in helium there can be very large deviations from local thermal equilibrium; in argon the reverse can be true, and good measurements of conventional plasma properties are possible; precursor effects in helium are very strong, and occur because of a very specific sequence of ultraviolet radiations from the discharge chamber, rather than from potential waves or particles. Preliminary studies of energy transfer in a plasma typical of pulsed argon-ion lasers indicate new relationships of trapping of resonance radiation and wall effects to laser behavior. Author (GRA)

N74-11556# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
COLLISIONAL COUPLING IN COUNTER-STREAMING LASER-PRODUCED PLASMAS Interim Report
David W. Koopman and Robert R. Goforth Jun. 1973 51 p refs
(Grants AT(40-1)-3819; AF-AFOSR-2225-72; AF Proj. 9751)
(AD-766731; BN-762; AFOSR-73-1590TR) Avail: NTIS CSCL 20/9

The collisional mechanisms by which a high density expanding plasma transfers momentum to an ambient stationary background are examined, and applied to the example of a laser-produced plasma. Experimental measurements of collisional modification of the ion flow field confirm the treatment used for momentum transfer rates. A numerical model which simulates the collisional coupling of an expanding laser-produced plasma to a photoionized background is developed; the results are compared to laboratory data to assess the degree to which collisional coupling influences experimental interaction studies in which both collisionless and collisional effects may be important. Author (GRA)

N74-11557*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
MAGNETICALLY INDUCED COLLISIONLESS COUPLING BETWEEN COUNTERSTREAMING LASER-PRODUCED PLASMAS
Augustine Y. Cheung, Robert R. Goforth, and David W. Koopman Apr. 1973 17 p refs
(Grants NGR-21-002-008; AF-AFOSR-2225-72; Contract AT(40-1)-3819; AF Proj. 9751)
(NASA-CR-136072; AD-766732; AFOSR-73-1591TR) Avail: NTIS HC $3.00 CSCL 20/9

A laser plasma, expanding through a photoionized background plasma under collisionless conditions, experiences a significant coupling with the background when an external 700 gauss field is applied transverse to the flow. A density maximum is formed which decelerates according to the predictions of a conserved-momentum coupling model. The results are consistent with theoretical treatments of magnetized two-stream instabilities. Author (GRA)

N74-11558# Texas Univ., Austin. Electronics Research Center.
TOROIDAL EQUILIBRIA OF FUSION PLASMA IN A CURVED THETA PINCH
Emmett L. Cantrell and Arwin A. Dougal 10 May 1973 129 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-766921; AFOSR-73-1531TR; TR-146) Avail: NTIS CSCL 20/9

The engineering problems associated with stabilizing the plasma drift due to the magnetic field gradient in a toroidal theta pinch are studied analytically and experimentally. The analysis is developed from the Lagrangian formulation for a dynamic circuit model. Stabilization by axial currents is realized from the formulation and agrees with reported experimental results. The formulation is applied to the equilibrium system using auxiliary helical fields of l-fold symmetry. The analysis includes image currents which are spatially periodic due to varying coil-to-wall spacing. The periodicity leads to an asymmetry in the vertical plane resulting in a destabilizing vertical force on the plasma column. A modified helical system with an axisymmetric field period twice that of helical field is proposed. Analysis demonstrates that this eliminates the undesired vertical force while preserving the horizontal force needed for equilibrium. (Modified author abstract) GRA

N74-11559# Advanced Technology Center, Inc., Dallas, Tex.
ELECTRON DENSITY MEASUREMENTS AT HIGH PRESSURES
William H. Rudderow Jun. 1973 33 p refs
(Contract F19628-73-C-0140; AF Proj. 4642)
(AD-766654; ATC-B-94300/3CR-19; AFCRL-TR-73-0436; SR-1) Avail: NTIS CSCL 20/9

Measurements of the electron density in the flow produced

by high velocity shock waves in air at initial pressures of 5 torr and 10 torr have been performed in an electromagnetic shock tube. The current collected by flush-mounted probes mounted in the wall of a rectangular cross section shock tube were used to deduce the electron density. Measurements were performed where the probes were biased to collect either ion current or electron current, and a simple theory was used to describe the probe characteristics. The flow conditions surrounding the probe were computed with engineering approximations of the wall boundary layer. A comparison of the measured results and the predicted values agree within a factor of two. Additional measurements of the current collected by a stagnation point electrostatic probe were also performed. Using simple theories, the measured electron density agrees with theoretical predictions within a factor of three. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-11560 Southern Methodist Univ., Dallas, Tex.
EXPERIMENTAL INVESTIGATION OF THE ELECTRONIC TRANSPORT PROPERTIES OF Hg(0.8)Cd(0.2)Te Ph.D. Thesis
Robert Stephen Ziernicki 1972 303 p
Avail: Univ. Microfilms Order No. 73-14482

An experimental study was made of the bulk electronic transport properties of the semiconductor alloy Hg(0.8)Cd(0.2)Te. In the theoretical description of this semiconductor material as well as in the analysis of experimental results, full account was taken of the nonparabolic conduction band shape through the Kane band model. A fit of the experimental data to the theoretical framework developed by Schmit to describe Hg(1-x)Cd(x)Te was accomplished with good results. Several independent experimental methods using galvanomagnetic, thermoelectric, and thermomagnetic techniques, were utilized to determine various transport parameters such as dominant scattering processes, Fermi energy, and degree of degeneracy from liquid nitrogen to room temperature. It is demonstrated that the dominant scattering process operative over this temperature range is due to a mixture of optical phonon and ionized impurity scattering and that the material is partially degenerate. Dissert. Abstr.

N74-11561 Washington Univ., Seattle.
GRAIN BOUNDARY MIGRATION IN ALUMINUM OXIDE Ph.D. Thesis
Robert Ward Burns 1973 147 p
Avail: Univ. Microfilms Order No. 73-13799

Aluminum oxide grain and twin boundary migration studies at 1500 to 2005 C were conducted on pressed and vapor grown bicrystals and on crystals containing rhombohedral deformation twins. Capillarity driving force models were generalized to meet such experimental observations as porosity along the pressed bicrystal grain boundaries and surface drag acting against the moving boundaries. Boundaries in the high purity vapor grown bicrystals moved the fastest, followed by porous pressed bicrystal boundaries, and with twin boundaries moving the slowest. One of the boundaries delineating a twin always moved relatively fast while the other remained pinned in an anomalous annealing groove. Activation energies for intrinsic and extrinsic boundary motion were determined for all three specimen types.
Dissert. Abstr.

N74-11562 Stanford Univ., Calif.
CgeAs2 AND CdGeP2 CHALCOPYRITE CRYSTALS FOR INFRARED NONLINEAR OPTICS Ph.D. Thesis
Helge Kildal 1973 183 p
Avail: Univ. Microfilms Order No. 73-14914

New crystals for infrared nonlinear optics are studied. The investigated crystals are II-IV-V2 semiconductor compounds with chalcopyrite structure. Both, theoretical and experimental results on growth technique, material quality problems, and semiconducting properties that affect the linear and nonlinear optical properties are reported. One of the crystals, CdGeAs2, had the highest figure of merit of any presently available infrared nonlinear material. In addition the crystal had an extensive parametric tuning range. The band structure of the chalcopyrites near the Brillouin zone center has also been determined and good agreement between calculated and measured intraband absorption in p-type CdGeAs2 was obtained. Dissert. Abstr.

N74-11563 Stanford Univ., Calif.
ACOUSTIC SURFACE WAVE INTERACTIONS IN PIEZOELECTRIC SEMICONDUCTORS Ph.D. Thesis
Stephen Ludvik 1973 183 p
Avail: Univ. Microfilms Order No. 73-14934

An experimental and theoretical study is presented of the effects of carriers on acoustic surface waves in piezoelectric semiconductors, and the application of these phenomena to microwave signal processing. The phenomena examined include both linear and nonlinear effects that arise from the space charge bunching produced by the acoustic waves. The experimental investigation was carried out using gallium arsenide as the piezoelectric medium. Within linear properties, the main surface modes in piezoelectric crystals are first discussed and, in the case of cubic piezoelectrics, the behavior of the surface shear (or Bleustein) mode is analyzed. It is shown that the properties of this mode are closely related to the bulk shear mode propagating in the same crystal direction. Along particular crystal surface directions it is possible to obtain amplification of acoustic waves through the traveling wave interaction with drifting carriers.
Dissert. Obstr.

N74-11564 Arizona State Univ., Tempe.
MORPHOLOGICAL EFFECTS OF SURFACE DIFFUSION AND EPITAXY ON GERMANIUM CRYSTAL SURFACES Ph.D. Thesis
Marshall Irvin Gurian 1973 176 p
Avail: Univ. Microfilms Order No. 73-13090

The process of chemical vapor deposition of epitaxial crystal deposits is widely employed in the manufacture of semiconductor devices. The process is satisfactorily controlled by empirical adjustment of reaction parameters. It was recognized that surface energy dependent phenomena account for some crystal morphological effects. The characteristics of the surface effects on single crystal germanium substrates are studied.
Dissert. Abstr.

N74-11565 Johns Hopkins Univ., Baltimore, Md.
MICROWAVE HALL MEASUREMENTS ON LOW MOBILITY SEMICONDUCTORS AND INSULATORS Ph.D. Thesis
Mohamed Metwally Sayed 1972 98 p
Avail: Univ. Microfilms Order No. 73-12169

A technique for the measurements of the Hall effect at microwave frequencies is described. The samples are placed at the center of a dual mode Te sub III cavity. A comparison between three types of receivers for the detection system is given. The scattering matrix is employed to determine the Hall mobility, and the microwave conductivity from the microwave measurements. A technique for temperature measurement and control of the sample is described. The typical procedure for tuning the cavity of orthogonality, degeneracy, and equal quality factors is presented. The Hall mobilities of copper phthalocyanine, one-dimensional conducting systems, and other organic and organometallic single crystals which are of interest are given.
Dissert. Abstr.

N74-11566 Rensselaer Polytechnic Inst., Troy, N.Y.
EFFECT OF STRAIN ON THE CRITICAL TEMPERATURE ON SUPERCONDUCTING THIN FILMS Ph.D. Thesis
Bruce Wharton Friday 1972 113 p
Avail: Univ. Microfilms Order No. 73-141-97

The effect of strain was measured for the critical temperature of superconducting thin films. The experimental values of T sub C and its strain dependence were found to agree with the McMillan theory for tin and aluminum films. The work indicates that the enhanced T sub C of aluminum films are a lattice dilation of resonable size. Dissert. Abstr.

N74-11567 Washington State Univ., Pullman.
STRESS RELAXATION IN SHOCK LOADED LITHIUM FLUORIDE SINGLE CRYSTALS Ph.D. Thesis

Yogendra Mohan Gupta 1973 151 p
Avail: Univ. Microfilms Order No. 73-14755

An experimental study of shock wave propagation along the < 100 > direction in lithium fluoride single crystals has been made. Two kinds of shock wave experiments were carried out. In the first, LiF single crystals were impacted with 6o61-T6 aluminum projectiles travelling at an average velocity of 0.343 mm/microsec the transmitted wave profiles were observed by quartz gauges bonded to the back of the specimens. In the other set of experiments, quartz gauges were impacted with LiF crystals travelling at an average velocity of 0.4 mm/microsec and the stress time profiles were observed at the impact face of the crystals. The experiments were done for two impurity concentrations and three heat treatments. Wave propagation up to a crystal thickness of 3.2 mm was studied. The highest precursor amplitude observed was 23.1 kbar while the lowest observed amplitude was 3.2 kbar. Dissert. Abstr.

N74-11568 Kansas State Univ., Manhattan.
THEORY OF EXTRINSIC ELECTRONICS STATES IN HIGH DIELECTRIC SEMICONDUCTORS Ph.D. Thesis
Mehmet Tomak 1972 116 p
Avail: Univ. Microfilms Order No. 73-13367

A theoretical study of the states of an electron, which is weakly bound to a substitutional donor impurity in a semiconductor, is presented. The impurity wave function is expanded after Kohn and Luttinger in terms of basis functions consisting of linear combinations of Bloch functions, from the lowest conduction band defined with respect to the conduction band minimum. The coefficients in the expansion are taken to be Fourier transforms of hydrogen-like functions, and the sum is restricted to the first Brillouin zone (BZ). The Kohn-Luttinger effectivemass approximation (EMA) is valid if the Fourier coefficients are so sharply localized about the conduction band minimum that essentially no error is made by extending the B.Z. sum to include all spaces. Calculations were performed to estimate the corrections that should be made to the matrix elements from this approximation in the cases where the Fourier coefficients are most extensive. Dissert. Abstr.

N74-11569 Universite des Sciences et Techniques de Lille (France). Centre de Recherches sur les Proprietes Hyperfrequences des milieux condenses.
FOLLOW-UP OF THEORETICAL AND EXPERIMENTAL STUDIES ON AVALANCHE SEMICONDUCTOR DIODE HIGH EFFICIENCY FREQUENCY MULTIPLICATION: POSSIBLE APPLICATIONS TO MILLIMETRIC WAVE HIGH POWER HF GENERATORS Final Report [POURSUITE DE L'ETUDE THEORIQUE ET EXPERIMENTALE DE LA MULTIPLICATION DE FREQUENCE A HAUT RENDEMENT A PARTIR D'UNE DIODE SEMICONDUCTRICE EN REGIME D'AVALANCHE. ETUDE DES POSSIBILITES D'APPLICATION A LA REALISATION DE GENERATEURS HYPERFREQUENCES DE FORTE PUISSANCE EN ONDES MILLIMETRIQUES RAPPORT FINAL]
E. Constant Oct. 1972 50 p refs In FRENCH
(Contract DGRST-71-7-2845)
Avail: Issuing Activity

ATT diodes on frequency multipliers at extremely high output frequencies were studied. Theoretical methods and models were developed to represent the diodes where both an avalanche zone and a transit zone are considered. A discrete treatment of continuity and Poisson equations were used to study the multiplication on oscillator regime. Circuits for multiplication are detailed emphasizing those with wide-based capabilities. Si components, encapsulated or not, were produced and a reproducibility study performed in view of millimetric wave production. Other parameters of interest were power performance, signal to noise ratios both in linear and nonlinear regime, efficiency and dopant optimization, and transit time in oscillator and amplifier mode. All studies were conducted with a multiplication factor of 10 and, in one case, of 25. Output powers, compared to free oscillation, are of the same order. The advantages of the process are indicated as: increased bandwidth, higher load impedance allowing the use of encapsulated components, reduced noise, automatic frequency stabilization to the input frequency, and uncritical component optimization. ESRO

N74-11570 Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Supraconducteurs.
RIBBON INTERMETALLIC COMPOUND Nb3Sn SUPRACONDUCTOR WELDS FOR SUPRACONDUCTOR SHORE CIRCUITS MANUFACTURING Final Report [ETUDE DE SOUDURES SUPRACONDUCTRICES SUR LE COMPOSE INTERMETALLIQUE Nb3Sn EN FORME DE RUBAN POUR L'OBTENTION DE COURT-CIRCUIT SUPRACONDUCTEUR RAPPORT FINAL]
J. Dosdat and J. Lanthiez Sep. 1972 20 p In FRENCH
(Contract DGRST-72-7-0113)
Avail: Issuing Activity

The Welding of Nb3Sn was accomplished by using a thin Sn film (obtained by a fluoroborate and fluoboric acid bath) to act as a mechanical reinforcing agent. Superconductor bridges were found to exist. The electric welding method was found superior to ultransonic welding where temperature duration and pressure parameters were optimized. The superconductor quality was demonstrated on short strips by the critical current method. The realization of superconductor windings was hampered by difficulties encountered at the external welding and also by contact resistance at the internal weldings sufficient to induce instabilities. ESRO

N74-11571 Radiotechniques S. A., Caen (France). Lab. de Recherches et de Developpements Avances.
INTERCONNEXION QUALITY PREDICTIVE CHARACTERIZATION FOR SILICIUM INTEGRATED CIRCUITS Final Report [CARACTERISATION PREVISIONNELLE DE LA QUALITE DES INTERCONNEXIONS DES CIRCUITS INTEGRES AU SILICIUM]
J. Rioult 12 Dec. 1972 45 p refs In FRENCH
(Contract DGRST-71-7-2975)
Avail: Issuing Activity

The degradation mechanisms and origins of quality control problems were investigated, for aluminum including: measurement of the temperature gradient by diffracted light intensity; electromigration analysis showing correlation between structure and lifetime; and creep buckling consequences (hillocks) inhibition by Si, Cu, Mg dopants or anodization. For Au welding on Al, the influence of the Al thickness and presence of a glass oven on welding quality is discussed. Experimental tests show that the capillary weight and temperature are also major factors in weld quality. The importance of Al anodization for multilayer interconnection is stressed for increased packing density within integrated circuits. ESRO

N74-11572 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
CATHODIC SPRAYING VANADIUM DEPOSITION Final Report [DEPOT DE VANADIUM PAR PULVERISATION CATHODIQUE]
P. Faulconnier and R. Poirier Dec. 1972 43 p refs In FRENCH
(Contract DGRST-71-7-2981)
Avail: Issuing Activity

Cathodic spraying of Va for MIS components was studied. The cathodic spraying techniques are detailed to reach 5% homogeneity in Va definition with properties similar to massive Va. The structure was studied by X-ray diffraction, and the density and thin film sensitivity were tested. A suitable (KTFR) photosensitive resin fluoboric acid, and a fluinitric acid solution of specified characteristic was defined for photolithographic cutting of Va on Si and Si02. A notable degradation in Q and dielectric regidity is found inside after Va deposition. The voltage barriers and contact resistance on N and p silicon were measured. ESRO

N74-11573 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
METALLURGICAL AND ELECTRICAL TREATMENT EFFECTS ON TRANSPORT PHENOMENA BETWEEN TWO METALLIC LAYERS Final Report [PHENOMENE DE TRANSPORT ENTRE DEUX COUCHES METALLIQUES EN FONCTION DES TRAITEMENTS METALLURGIQUES ET ELECTRIQUES]
Michel Croset Dec. 1972 30 p refs In FRENCH
(Contract DGRST-71-7-2973)
Avail: Issuing Activity

A study of double metal layers on semiconductor substrates

for reliable VHF connections is presented. Metals in contact with Si were Ta, Ti, W, Mo, Cn, Zn. The outer metals were Al and Au. Spraying methods, such as diode cathodic spraying, Joule heating evaporation, and ultra vacuum evaporation by electron guns are detailed in terms of technique optimization in the thickness range between a few hundred and a few thousand Angstroms. Selective chemical attack techniques of the inner metal are discussed in respect of Si, SiO2 and the outer metal. The metal-metal-Si structures are characterized by contact resistance at the interfaces and electrical stability of thin diodes (0.1 micron) thus metallized. Results made it possible to select three metallic couples (Al-Ta, Au, Mo, Au-W) for which deposition and chemical treatment procedures are detailed. These structures retain their properties under a thermal stress of one hour at 500 C. ESRO

N74-11574 Radiotechniques S. A., Caen (France). Lab. de Recherches et de Developpements Avances.
DEGRADATION MECHANISMS AND ELECTROLUMINESCENT COMPONENTS IMPROVEMENT IN THE VISIBLE AND INFRARED SPECTRAL RANGE Final Report [ETUDE DES MECANISMES DE DEGRADATION ET PERFECTIONNEMENT DES COMPOSANTS ELECTROLUMINESCENTS DANS LES SPECTRES INFRA-ROUGE ET VISIBLE]
C. Gouin, D. Diguet, and J. Lebailly 14 Dec. 1972 38 p refs In FRENCH
(Contract DGRST-71-7-2743)
Avail: Issuing Activity

Degradation mechanisms in GaAs and GaAsP electroluminescent diodes is presented. An analysis method combining the evolution of luminosity, injected current, and volt-ampere characteristics is detailed, making it possible to separate variations of quantic efficiencies from injection efficiencies. Use of electron microscopy in the cathodoluminescent mode or induced current mode, capacitance measurements, IR microscopy, X-ray topography, and chemical analysis by atomic absorption and colorimetry allowed the identification of three main degradation mechanisms, i.e. mechanical stresses, point defects generation, and contaminant migration. The influence of current density, function temperature, additive nature, junction manufacturing procedures, and crystal quality, are detailed. A Zn diffusion device with open tube was realized as well as a masking device using Si3N4 directly engraved that was found suitable for industrial applications. ESRO

N74-11575 Compagnie Generale d'Electricite, Marcoussis (France). Dept. Energie.
DEVELOPMENT OF ELECTRICAL WINDINGS USING VERY THIN WIRES Final Report [REALISATION DE BOBINES A BASE DE FILAMENTS TRES FINS RAPPORT FINAL]
Berthet, Jomard, Lesage, and Moisson Dec. 1972 58 p refs In FRENCH
(Contract DGRST-71-7-2962)
Avail: Issuing Activity

Three different aspects, using very thin wires, of developing superconducting electrical windings are discussed. (1) Critical characteristics of multifilamentary copper coated filaments were studied on short samples with static magnetic induction, using dc current slowly varying in the wire. The windings were also studied under simular conditions and the results and conclusions are detailed. (2) To cool the new conductor materials, various systems were investigated in which drains and lateral radiators were used separately or in conjunction. Theoretical results deal with the degree of heating of the wires and the savings in superconduction material achievable. Experimental results give the values of thermal resistance and behavior in the impulse thermal regime. (3) Technological procedures, for Nb-Ti wires coated with Al alloy, are given for optimum extrusion conditions. The superconductor characteristics after extrusion, electrical insulation characteristics, epoxy resin material choice, and dielectric tests are discussed together with the minimal thickness of Al alloy required. ESRO

N74-11576 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
VAPOR PHASE VANADIUM DEPOSITION FROM VANADIUM CHLORIDE VCI4 Final Report [DEPOT EN PHASE VAPEUR DE VANADIUM A PARTIR DE CHLORURE DE VANADIUM VC14 RAPPORT FINAL]
A. Faucher, B. Kervella, and J. Pierre Dec. 1972 45 p refs In FRENCH
(Contract DGRST-71-7-2980)
Avail: Issuing Activity

Thermal reduction of VCI4 in an RF furnace was used. The effect of variation of the following parameters is detailed: reaction temperature in the range from 600 to 1250 C VCI4 concentration, gaseous HCL addition, gaseous C-12 addition, substitution of He to H, substrate influence (Si or SiO2), and influence of the preparation of VCI4 (commercial or in situ). Under no circumstances was a successful V deposition onto Si reached. A thermodynamic study demonstrated that the metal pressures are always negative, at atmospheric temperature, for a temperature range from 800 to 1500 K. At lower temperatures experiments showed that the V layer does not adhere to the Si substrate. ESRO

N74-11577 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
CdS ELECTROLUMINESCENCE USING FIELD EFFECT STRUCTURES Final Report [ETUDE DE L'ELECTROLUMINESCENCE DANS LE CdS A L'AIDE DE STRUCTURE A EFFECT DE CHAMP]
M. Malard Oct. 1972 35 p refs In FRENCH
(Contract DGRST-70-02-277)
Avail: Issuing Activity

A study of electroluminescence in CdS with field effect structures is presented. Theoretical findings are: (1) The induced inversion layer exhibits a sufficient superficial carrier density to yield, at 50 Hz, and for quantic efficiencies lower than 0.5%, a luminosity from 0.1 to 10 mins W/sq cm. (2) The formation mechanism of the carrier is by avalanche process in the semiconductor material. (3) Operating voltages between 5 and 50 V are possible. Experimental results show the possibility of obtaining radiative efficiencies from 10 to 70%. (4) The average electric field in the insulator is of the order 4 to 8 MV/cm. A reactive evaporation technique is detailed for production of Al2O3 thin films at room temperature and having the required properties. ESRO

N74-11578 Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Lab. d'Analyses Physiques.
X-RAY TOPOGRAPHY Final Report [ETUDE DE LA TOPOGRAPHIE EN RAYONS X]
G. Blet and M. Arnaud Nov. 1972 63 p refs In FRENCH
(Contract DGRST-72-7-0090)
(Rept-2.564) Avail: Issuing Activity

X ray topography for planar Si transistors is presented. The aims are to characterize the Si substrate, diffusion process, and epitaxy by reflection X-ray methods. Topometric measurement methods, insturmental adaptations, and ion implantation are detailed. Theoretical results show that a 50 by micron microfocus is best adapted for high resolution and exposure time. For penetration depths of order one micron the K-alpha Cr radiation in the (220) plane of (111) Si is most advantageous. Experimental results show that local diffusion induced parameter variation of order 0.0001 are detectable. Characterization of microdiffusions of B2O3 and H2O corrosion are evidenced. Microphotometry of contrast variations due to P implantation at various depths is discussed. A Berg-Barrett bench is used to characterize Si(100) substrates by Cu K-alpha 2 on (533) planes. A good correlation is obtained in some cases with the values of the surface avalanche field. ESRO

N74-11579 Paris Univ. (France).
STUDY OF GROUP 4-6 SEMICONDUCTOR MATERIALS FOR OPTOELECTRONIC APPLICATIONS Final Report, Jan. 1970 - 30 Jul. 1972 [ETUDE DES MATERIAUX SEMICONDUCTEURS DU GROUPE IV-VI EN VUE DE LEURS APPLICATIONS EN OPTOELECTRONIQUE]
M. Balkanski and G. Martinez 30 Jul. 1972 17 p refs In FRENCH; ENGLISH summary
(Contract DGRST-70-02-181)
Avail: Issuing Activity

The electronic properties of 46 semiconductors were analyzed using ultraviolet photoemission, lasing effect, photovoltaic effect, and magneto-reflectivity measurements. Results obtained on band

structure, dielectric and emission properties of PbSe and Pb(1-x)Se(x)Se are interpreted. The direct current relaxation process was investigated, as well as photodetection properties, including a study on the lifetime of these materials. Further work is suggested in order to apply 46 semiconductors to opto-electronics, and to include investigations on transport phenomena (detector applications) and on radiative and nonradiative recombination process (emitter applications). ESRO

N74-11580 Paris Univ. (France). Lab. de Physique des Solides.
BAND STRUCTURE AND OPTICAL PROPERTIES OF SMALL GAP SEMICONDUCTORS AND ALLOYS
M. Balkanski 1972 39 p refs Sponsored by Delegation a la Rech. Sci. et Tech.
Avail: Issuing Activity

Materials having a small energy gap and thus giving rise to direct optical transitions were considered and their electronic band structure examined in connection with their optical properties. Materials under study included IV-VI compounds, taking as a typical example PbSe, and II-VI compounds, taking as an example H6Te, as well as their alloys. Their optical properties were examined to determine the nature and particularities of elementary excitations such as phonons and plasmons. The dielectric function and its intraband, interband, and phonon contributions were analyzed and the reflectivity versus wavenumber was given as an illustration of optical properties in the infrared region. ESRO

N74-11581# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Metallforschungslab.
INVESTIGATIONS ON THE CRITICAL CURRENT DENSITY OF VAPOR DEPOSITED Mb3Sn [UNTERSUCHUNGEN ZUR KRITISCHEN STROMDICHTE VON Nb3Sn GASPHASENSCHICHTEN]
Karl Wohlleben Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1973 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-11) Avail: NTIS HC $3.75; ZLDT Munich 6, 75 DM

The effect of carbon and oxygen on the critical current density of vapor deposited Nb3Sn superconductors was investigated. The addition of carbon during the deposition of Nb3Sn from the vapor phase results in a considerable increase of the critical current density. This reaches a maximum of approximately 1 million A/sq cm at 5 T with about 3 at.% carbon. When irradiated with 2 MeV protons the current density of a non-optimally C-doped layer increases further while the current density of an optimally doped layer decreases. Annealing for a short period at 600-800 C leads to an increase in current density by an average of 60%, irrespective of the initial current density. The pinning centers produced by carbon doping and by irradiation are superposed. Author (ESRO)

N74-11582# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Metallforschungslab.
INFLUENCE OF PROTON IRRADIATION ON THE CRITICAL CURRENT DENSITY J SUB C (B,T) OF NbTi [EINFLUSS VON PROTONENBESTRAHLUNG AUF DIE KRITISCHE STROMDICHTE j SUB c (B,T) VON NbTi]
Karl Wohlleben Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1973 49 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-12) Avail: NTIS HC $4.50; ZLDI, Munich 10.30 DM

The critical current density of a copper coated single-core wire of Nb-50 wt% Ti was investigated with respect to the flux density (between 1T and 8T) and the temperature (between 2.5K and Tc). Irradiation with 3.1 MeV protons at 25 K led to a Tc drop of 0.17 K and a nearly uniform degradation of 19% over the entire surface. After annealing for one hour at 285 K, only 40% of the degradation remained. Author (ESRO)

N74-11583# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
DETECTION AND EMISSION OF RADIATION BY ARRAYS OF JUNCTIONS
T. D. Clark 1 Sep. 1973 48 p refs
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-766503; TR-13) Avail: NTIS CSCL 20/12

The report discusses the interaction of small regular planar arrays of point contact Josephson junctions with an electromagnetic field, either self-generated or externally applied. It reviews the experimental data obtained in terms of a single frequency, super-radiant state for the point contact array. GRA

N74-11584# Cornell Univ., Ithaca, N.Y. Materials Science Center.
MEASUREMENT OF THE PROBABILITY DISTRIBUTION OF THERMALLY EXCITED FLUXOID QUANTUM TRANSITIONS IN A SUPERCONDUCTING RING CLOSED BY A JOSEPHSON JUNCTION
L. D. Jackel, W. W. Webb, J. E. Lukens (State Univ. of N. Y., Stony Brook), and S. S. Pei (State Univ. of N. Y., Stony Brook) 10 Sep. 1973 19 p refs
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-766659; MSC-2091) Avail: NTIS CSCL 20/2

The thermally induced distribution of transitions between fluxoid quantum states of a superconducting ring closed by a Josephson junction has been measured. The observed dependence of its width on temperature, ring inductance, and weak link critical current, as well as its shape confirm the recent theoretical results of J. Kurkijarvi. (Modified author abstract) GRA

N74-11585# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DERIVATION OF CRACK ELEMENT-STIFFNESS MATRIX BY THE COMPLEX VARIABLE APPROACH
Samuel J. Lasry Feb. 1973 35 p refs
(Contract F44620-72-C-0018; AF Proj. 9782)
(AD-766922; ASRL-TR-170-2; AFOSR-73-1602TR) Avail: NTIS CSCL 20/12

The problem of crack analysis and stress singularities at the tip of a crack, has, up to now, been approached either in an analytical fashion, using complex variables and conformed mapping, or with the finite-element method, using elements which may or may not account for the singular stresses around the tip of the crack. The following study defines a so-called special element to be used at the crack tip in conjunction with the general finite-element method. It was proved to be more efficient than previous methods for it accounts more fully for stress singularities. The element-stiffness matrix was derived using conformal mapping of the special element into a more readily usable one. Author (GRA)

N74-11586# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ZONE STRUCTURE AND ELECTRON SCATTERING MECHANISM IN THE SOLID SOLUTIONS Hg(1-x)Cd(x)Te
S. A. Aliev, E. Aliev, T. G. Gadzhiyev, and M. I. Aliyev 22 Aug. 1973 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 10, 1971 p 1685-1689
(AD-766564; FTD-HT-23-025-74) Avail: NTIS CSCL 09/1

In this work of zone structure on the Cd content in atomic percents in the Hg(1-x)Cd(x)Te alloys and to clarify the prevalent electron scattering mechanism in this system. With this in mind, macrocloud samples with n-type conductivity were obtained in the range 0 equal to or less than 0.2 by fusing the initial components. GRA

N74-11587# Massachusetts Inst. of Tech., Cambridge.
DETERMINING ACCURATE SUPERCONDUCTING TUNNELING ENERGY GAPS: ANISOTROPY IN SINGLE-CRYSTAL Nb
J. Bostock, Kofi Agyeman, M. H. Frommer, and M. L. A. MacVicar 11 Sep. 1973 15 p refs Sponsored in part by NSF
(Contract N00014-67-A-0204-0041)
(AD-766482; TR-10) Avail: NTIS CSCL 20/12

Superconducting tunneling experiments on niobium single crystals with indium and lead-bismuth counter-electrodes show an isotropic energy gap value of 3.12 plus or minus 0.05 meV, or 3.93 kT(c), for 26 junction orientations. Self-consistent analysis criteria have been developed for the determination of gap values. These criteria are not met in the existing literature on transition metal tunneling. Author (GRA)

N74-11588# Florida Univ., Gainesville. Dept. of Electrical Engineering.
A CENTER OF COMPETENCE IN SOLID STATE MATERIALS AND DEVICES Final Report, 1 Sep. 1967 - 1 Sep. 1972
Fredrik A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Larry L. Hench, and Sheng S. Li 10 Oct. 1972 214 p refs
(Contract F19628-68-C-0058; ARPA Order 1010; AF Proj. 8687)
(AD-766406; AFCRL-TR-73-0164) Avail: NTIS CSCL 20/12

The five-year research program sponsored by this contract has produced technical findings in several areas: Characterization of semiconductor devices and integrated circuits, electronic ceramics, quantum and electronic properties of semiconductors and related devices, noise in solids and in solid-state devices, magnetic films, high current regimes in transistor collector regions, quantum yield of p-i-n photodiodes, cluster model calculations of silicon defects, investigation of recombination and trapping processes in 3As2Se3-2Sb2Se3 amosphous films by photoconductivity method, and dielectric properties of lithium-disilicate glass-ceramics. GRA

N74-11589# Pennsylvania Univ., Philadelphia. Dept. of Physics.
RAMAN SCATTERING IN NARROW-GAP SEMICONDUCTORS Ph.D. Thesis
Leonard Jack Brillson 1972 193 p refs
(Contract DA-31-124-ARO(D)-239)
(AD-766853; AROD-4882-32-P) Avail: NTIS CSCL 20/12

The nature of the Raman scattering process is discussed, as well as the form of the Raman scattering cross-section and the way in which various excitations can contribute to the scattering. The lattice dynamics of the zero-gap semiconductor (semi-metal) graphite is investigated. A description of the Raman equipment and experimental procedure is also presented. Electric field-induced Raman scattering is introduced and a general background of the two important types of electric field-induced experiments is presented which focusses on paraelectric soft mode behavior and the effects of surface space charge regions. Surface electric field-induced Raman scattering in the cubic IV-VI compound semiconductors PbTe, PbS, PbSe, and SnTe is investigated. GRA

N74-11590# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Nuclear Engineering.
INVESTIGATION OF THE ABSORPTION COEFFICIENT OF NEUTRON IRRADIATED SILICON DOPED WITH Li OR Cu Final Report, 15 Sep. 1971 - 30 Jun. 1973
Chau Shion Chen and John C. Corelli 1 Jul. 1973 72 p refs
(Contract F19628-72-C-0032; AF Proj. 5621)
(AD-766768; AFCRL-TR-73-0431) Avail: NTIS CSCL 20/12

Infrared spectroscopy studies, of Li, and Cu-doped and Li-B compensated irradiated Si are reported. In Li-containing Si, divacancy-associated bands and several new bands were observed which are associated with at least three different defect complexes in which lithium impurities are directly involved. The production and recovery of divacancies depend strongly upon the Li concentration. Simple lithium-associated defects, such as the Li-vacancy, are also produced during irradiation whose dissociation enhances the concentration of other Li-associated defect complexes. In Li-B compensated Si, several new absorption bands and a huge near-edge absorption are observed accompanied by a decrease in the Li-B vibrational bands during irradiation. The near-edge absorption depends not only on the neutron fluence but also on the number of Li-B pairs which play an important role in the formation of defect complexes. No Cu-associated band is observed before or after irradiation of the Cu diffused samples. The presence of Cu impurities in Si does not affect the production of the divacancy, implying no interaction of Cu with radiation-induced defects. Author (GRA)

N74-11591# , North Carolina Univ., Chapel Hill. Dept. of Physics.
MAGNETIC AND OPTICAL PROPERTIES OF DEFECT-STABILIZED CHARGE STATES OF RARE-EARTH ATOMS Final Report
Dietrich Schroeer 7 Sep. 1973 15 p refs
(Grant AF-AFOSR-2011-71)
(AD-766948; AFOSR-73-1639TR) Avail: NTIS CSCL 20/12

The Mossbauer effect has been used to investigate the production and defect stabilization of Co, Fe, Eu and Dy in a variety of crystals. The experiments include studies of the site and valence-state distribution of Co and Fe in spinels, of very short-lived tetravalent states of Eu and Dy produced by alpha-particle bombardment, of divalent Eu in calcium difluoride and its conversion to trivalent Eu, and of Fe surface defects in hematite. Author (GRA)

N74-11636* Ohio State Univ., Columbus. Dept. of Physics.
GROUND STATE ENERGY OF SOLID MOLECULAR HYDROGEN AT HIGH PRESSURE
C. Ebner and C. C. Sung *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 83-90 refs
(For availability see N74-11621 02-30)
Copyright. CSCL 20L

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-11592# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
AVIATION TURBINE FUELS, 1972 Petroleum Products Survey No. 79
Ella Mae Shelton Mar. 1973 15 p refs
Avail: NTIS HC $3.00

Properties of aviation turbine fuels produced in the United States during 1972 are reported in accordance with a cooperative agreement between the American Petroleum Institute and the Bureau of Mines of the United States Department of the Interior. By agreement with the American Petroleum Institute, identification of the data by item number is confidential. Analytical data are presented for 117 samples of aviation turbine fuels, representing the products of 16 companies. The data were reported by the manufacturers as typical of their 1972 production. The analyses were made in their laboratories and the results submitted to the Bureau of Mines for compilation. Author

N74-11593# Explosives Research and Development Establishment, Waltham Abbey (England).
THE SCOPE AND METHODS OF ENVIRONMENTAL TESTING OF DOUBLE-BASE PROPELLANT ROCKET MOTORS: CHOICE OF CONDITIONS AND INTERPRETATION OF RESULTS
J. Gooding Feb. 1973 14 p Presented at the Ann. Symp. of the Inst. fuer Chemie der Treib- und Explosivstoffe, Karlsruhe, West Ger., 27-29 Sep. 1972
(ERDE-TN-86; BR35757) Avail: NTIS HC $3.00

Environmental testing problems are considered, primarily from the standpoint of the propellant chemist. Environments are defined and the significant aspects of motor design and possible failure modes considered. Preliminary tests, and environmental tests proper, which aim to simulate storage, transport and handling hazards in a realistic manner, are discussed, together with the size and scope of a test program. In conclusion the importance of surveillance is emphasized, in order that the results of these programs can be checked and adequate reasons established to account for any failures. Author (ESRO)

N74-11594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF THE THEORY OF PROCEDURES IN ROCKET SYSTEMS ON SOLID FUEL
B. A. Rayzberg, B. T. Erokhin, and K. P. Samsonov 25 Jul. 1973 660 p refs Transl. into ENGLISH of the publ. "Osnovy Teorii Rabochikh Protsessov v Raketnykh Sistemakh na Tverdom Toplive" USSR, 1972 p 1-384
(AD-766567; FTD-MT-24-110-73) Avail: NTIS CSCL 21/9

The book discusses the physical bases and methods of theoretical calculation of gas-dynamic and intraballistic processes occurring in solid-propellant rocket systems: engines, generators, rocket-barrel setups. Attention is given to the deriving of

dependences of the basic parameters of working processes, to analyzing conditions and areas of their application and to contriving simplified engineering methods for their calculation and evaluation. A gas-dynamic theory of intraballistic processes is developed in detail and equations of motion of homogeneous and two-phase combustion products in a chamber are obtained. Also described are methods of calculating steady-state values of the intraballistic characteristics of systems. Methods of calculating thrust, specific thrust and specific impulse and losses of specific impulse in a combustion chamber and in a nozzle are examined. GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-11595 Association Technique pour la Turbine a Gaz, Paris (France).
SEARCH FOR A FULLY NUMERICAL METHOD OF TURBOMACHINE BLADES CALCULATION Final Report [RECHERCHE D'UNE METHODE ENTIEREMENT NUMERIQUE DE CALCUL DES AUBES DE TURBOMACHINES]
Michel Pluviose 29 Jan. 1973 11 p In FRENCH
(Contract DGRST-69-01-856)
Avail: Issuing Activity

A project for the development of a numerical method to calculate turbomachine blades is reported. The method allows defining a blade by continuous evolution, and is based on the choice of hodograph contours corresponding to the different sections. The evolution of boundary layers on a chosen profile is also included in the calculation. ESRO

N74-11596*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLUME MASS FLOW AND OPTICAL DAMAGE DISTRIBUTIONS FOR AN MMH/N2O4 RCS THRUSTER
Ernie W. Spisz, Robert L. Bowman, and John R. Jack 1973 17 p refs Presented at 7th Space Simulation Conf., Los Angeles, 12-14 Nov. 1973; sponsored by AIAA, Am. Soc. for Testing and Mater., and the Inst. of Environ. Sci.
(NASA-TM-X-71465) Avail: NTIS HC $3.00 CSCL 21H

The data obtained from two recent experiments conducted in a continuing series of experiments at the Lewis Research Center into the contamination characteristics of a 5-pound thrust MMH/N2O4 engine are presented. The primary objectives of these experiments were to establish the angular distribution of condensible exhaust products within the plume and the corresponding optical damage angular distribution of transmitting optical elements attributable to this contaminant. The plume mass flow distribution was measured by five quartz crystal microbalances (QCM's) located at the engine axis evaluation. The fifth QCM was located above the engine and 15 deg behind the nozzle exit plane. The optical damage was determined by ex-situ transmittance measurements for the wavelength range from 0.2 to 0.6 microns on 2.54 cm diameter fused silica discs also located at engine centerline elevation. Both the mass deposition and optical damage angular distributions followed the expected trend of decreasing deposition and damage as the angle between sensor or sample and the nozzle axis increased. A simple plume gas flow equation predicted the deposition distribution reasonably well for angles of up to 55 degrees. The optical damage measurements also indicated significant effects at large angles. Author

N74-11597*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
RADIALLY LEANED OUTLET GUIDE VANES FOR FAN SOURCE NOISE REDUCTION
S. B. Kazin Nov. 1973 86 p refs
(Contract NAS3-12430)
(NASA-CR-134486; R73AEG176) Avail: NTIS HC $6.50 CSCL 20A

Two quiet engine program half scale fans one with a subsonic and the other with a supersonic fan tip speed at takeoff were run with 30 degree leaned and radial outlet guide vanes. Acoustic data at takeoff fan speed on the subsonic tip speed fan showed decreases in 200-foot sideline noise of from 1 to 2 PNdb. The supersonic tip speed fan a takeoff fan speed, however, showed noise increases of up 3 PNdb and a decrease in fan efficiency. At approach fan speed, the subsonic tip speed fan showed a noise decrease of 2.3 PNdb at the 200-foot sideline maximum angle and an increase in efficiency. The supersonic tip speed fan showed noise increase of 3.5 PNdb and no change in efficiency. The decrease in fan efficiency and the nature of the noise increase largely high frequency broadband noise lead to the speculation that an aerodynamic problem occurred. Author

N74-11598*# Boeing Co., Seattle, Wash. Spacecraft Div.
HEUS-RS APPLICATIONS STUDY, VOLUME 1 Final Report
Jun. 1972 107 p refs
(Contract NAS2-6518)
(NASA-CR-130274; D2-116262-1-Vol-1) Avail: NTIS HC $7.50 CSCL 21H

Studies are given for sizing and integrating a high energy upper stage restartable solid motor into a flight stage with various payloads for use with Titan 3 and Thor launch vehicles. Motor and stage configurations are given along with performance evaluation of the HEUS-RS with the space shuttle. Author

N74-11599*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TEST REPORT FOR 120-INCH-DIAMETER SOLID ROCKET BOOSTER (SRB) MODEL TESTS
William C. Jones Aug. 1973 96 p refs
(NASA-TM-X-69441; KSC-TR-1253) Avail: NTIS HC $7.00 CSCL 21H

The space shuttle solid rocket boosters (SRB's) will be jettisoned to impact in the ocean within a 200-mile radius of the launch site. Tests were conducted at Long Beach, California, using a 12-inch diameter Titan 3C model to simulate the full-scale characteristics of the prototype SRB during retrieval operations. The objectives of the towing tests were to investigate and assess the following: (1) a floating and towing characteristics of the SRB; (2) need for plugging the SRB nozzle prior to tow; (3) attach point locations on the SRB; (4) effects of varying the SRB configuration; (5) towing hardware; and (6) difficulty of attaching a tow line to the SRB in the open sea. The model was towed in various sea states using four different types and varying lengths of tow line at various speeds. Three attach point locations were tested. Test data was recorded on magnetic tape for the tow line loads and for model pitch, roll, and yaw characteristics and was reduced by computer to tabular printouts and X-Y plots. Profile and movie photography provided documentary test data. Author

N74-11600# Battelle Columbus Labs., Ohio.
PRESS BRAKE-ROLL AND WELD FABRICATION OF PROTOTYPE LARGE-DIAMETER MISSILE MOTOR CASES: PRODUCTION COST ESTIMATES
R. A. Mueller 13 Sep. 1973 15 p
(Contract DAAH01-72-C-0821)
(AD-766342) Avail: NTIS CSCL 21/8

The report analyses production costs for manufacturing 16 inches rocket motor cases by utilizing various fabrication techniques and varying casing materials. GRA

N74-11601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ECONOMIC EFFICIENCY OF RAISING THE FLYING LIFE AND RELIABILITY OF GAS-TURBINE ENGINES
V. M. Akimov, D. E. Starik et al 30 Aug. 1973 243 p refs Transl. into ENGLISH of the mono. "Ekonomicheskaya Effektivnost Povysheniya Resursa i Nadezhnosti Gasoturbinnykh Dvigatelei" USSR, 1972 p 1-170
(AD-767027; FTD-MT-24-291-73) Avail: NTIS CSCL 21/5

The report relates to the development of contemporary concepts of reliability and service life of aviation gas-turbine engines (GTE) and to an examination of the technical and economic aspects of the problem of ascertaining and increasing engine

service life. The basic criteria of evaluating reliability of GTE are examined and the principles of approaching the solution of questions of ascertaining service life taking economic factors into account are examined. Methods of evaluating the economic efficiency of increasing service life and reliability of engines are discussed and an analysis of the dependence of expenditures for series and repair work on the length of service life is presented. GRA

N74-11602# Washington Univ., Seattle. Aerospace Research Lab.
THROUGHFLOW THEORY FOR TURBOMACHINES Final Report, Oct. 1971 - May 1972
Gordon C. Oates and Charles J. Knight Wright-Patterson AFB, Ohio AFAPL Jun. 1973 120 p refs
(Contract F33615-72-C-1082; AF Proj. 3066)
(AD-766537; AFAPL-TR-73-61) Avail: NTIS CSCL 21/5

Throughflow theory for flow in axial turbomachines is formulated in a way to allow consideration of the effects of variable hub and tip radii, the effects of free boundaries and the effects of compressibility. A procedure is developed for the very rapid calculation of incompressible flow through many blade rows in an annulus of constant hub and tip radii. An analysis formulation including the effects of variation in wall radii is also presented. A variational procedure for the numerical description of highly nonlinear flow field is developed for the description of incompressible flows through many blade rows in ducts of varying hub and tip radii. The associated computer program leads to rapid calculation of desired examples. Finally, a computer program is given to calculate the effects of compressibility on radial equilibrium flows. Author (GRA)

N74-11603# Lockheed Propulsion Co., Redlands, Calif.
HYDROQUENCH THRUST TERMINATION ANALYSIS Final Report, 1 Feb. 1972 - 15 May 1973
David P. Harry, III and Norman S. Cohen Edwards AFB, Calif. AFRPL Aug. 1973 232 p refs
(Contract F04611-70-C-0071)
(AD-766770; LPC-470-FF; AFRPL-TR-73-62) Avail: NTIS CSCL 21/8

The objective of the amended contract was the development of a computer program to predict the internal ballistics of the hydroquench thrust termination process. The starting point was the computer program developed under the original contract, Ballistics Predictions for Mass-Augmented Solid Rocket Motors. The gas generator of the mass-augmented motor is replaced with a subroutine describing the spatial and temporal properties of the injected water throughout the motor. The solid propellant combustion model and the overall interior ballistics analysis remain essentially intact. The novelty of major importance is the interface between the water analysis and the combustion analysis: description of extinguishment by water contacting the propellant surface. This surface heat transfer process is distinguished from auxiliary extinguishment processes, which also are present in mass-augmentation. (Modified author abstract) GRA

N74-11604# Battelle Columbus Labs., Ohio.
CURRENT AND FUTURE MATERIALS USAGE IN AIRCRAFT GAS TURBINE ENGINES
Ward F. Simmons Jun. 1973 100 p refs
(Contract DSA900-73-C-0922)
(AD-766334; MCIC-73-14) Avail: NTIS CSCL 21/5

The report gives the current state-of-the-art of materials usage in aircraft gas turbine engines including auxiliary power units, and discusses the trends in future materials such as composites, powder metallurgy, controlled solidification, eutectic alloys, refractory metals, and ceramics. Also, discussed are new processing techniques such as thermomechanical processing (TMP) and Gatorizing, trade name. The appendix has 17 tables of materials used for components in such current production engines as the P-WA JT9D and the G.E. CF-6. The appendix also has a glossary of gas turbine engine terms. Author (GRA)

N74-11605# ARO, Inc., Arnold Air Force Station, Tenn.
EMISSION MEASUREMENTS OF A J93 TURBOJET ENGINE Final Report, 8 Jun. - 31 Jul. 1972
D. L. Davidson and A. F. Domal AEDC Sep. 1973 99 p refs
(AD-766648; ARO-ETF-TR-73-46; AEDC-TR-73-132) Avail: NTIS CSCL 21/5

Exhaust gas emission measurements were made at the nozzle of a J93 turbojet engine at simulated flight conditions from sea-level static to Mach 2.0 at 75,000 ft and Mach 2.6 at 65,000 ft. Real time measurements of CO, CO2, CxHy, NO, and NOx were taken over a range of after-burning and nonafterburning engine power settings using a gas sampling system designed to adhere to SAE ARP 1256 specifications. In addition, NO and OH were measured in situ by a narrow-line UV spectral absorption technique. Batch-type measurements of particulates and other trace constituents of the exhaust gas were also made. Major results of the test were that emissions vary significantly with combustor inlet pressure and temperature and, therefore, with Mach number and altitude. (Modified author abstract) GRA

N74-11606# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SENSING JET ENGINE PERFORMANCE AND INCIPIENT FAILURE WITH ELECTROSTATIC PROBES Technical Report, 1 Sep. 1969 - 15 Nov. 1971
Robert P. Couch and Dennis R. Rossbach Dec. 1972 114 p refs
(AF Proj. 8222)
(AD-766653; AFFDL-TR-71-173) Avail: NTIS CSCL 01/4

Jet exhaust plasma densities have been investigated with electrostatic probes and have been found to vary exponentially from 3 x 3,000,000 cubic centimeters to 4 x 10 to the 7th power cubic centimeters depending on the mixture ratio. The plasma has been found to contain few electrons and to be primarily positive and negative ions. It has been discovered that electrostatic probes can be used to detect the particles which proceed a number of jet engine failures. Two theories are set forth; one for interpreting the I-V trace and one for the current spikes seen prior to jet engine failures. Further studies are recommended to exploit the engine failure prediction capabilities and use the mixture ratio sensitivity to obtain engine performance and to predict compressor stalls. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-11607 California Inst. of Tech., Pasadena.
SOFT X-RAYS FROM THE CYGNUS LOOP Ph.D. Thesis
John Charles Stevens 1973 226 p
Avail: Univ. Microfilms Order No. 73-14318

A soft X-ray survey of the Cygnus Loop, obtained from a rocket-borne experiment, provides evidence that the X-ray emission from this supernova remnant is produced by the interaction of a shock wave and the interstellar medium. A spatial map, having 0.5 by 0.5 deg resolution, of the structure of the Cygnus Loop in 0.2 to 1.5 kev X-rays is presented. The map shows regions of X-ray emission which correlate well with features at radio and optical wavelengths. It also shows regions for which the antithesis holds. A spectral examination of the total emission from the Loop by a proportional counter equipped with a two element filter system, shows evidence for line emission between 530 and 690 ev. The overall spectrum is found to be well represented by a thermal bremsstrahlung spectrum with line emission. Dissert. Abstr.

N74-11608# Pennsylvania State Univ., University Park. Dept. of Astronomy.
A CATALOG OF MATRIX DIAGRAMS FOR SIMPLE AND COMPLEX MICROWAVE SOLAR RADIO EVENT MORPHOLOGICAL PARAMETERS
Frederick L. Wefer May 1973 308 p refs
(Grant NSF GA-28122)
(SR-027) Avail: NTIS HC $17.50

Morphological parameters for use in numerically describing the flux density functions of microwave solar radio distinct events

are discussed. Statistical relationships between pairs of these parameters can yield clues to the physics of the solar flare phenomenon. Past studies of these relationships have generally been restricted to a few pairs of the morphological parameters. Modified scatter diagrams called matrix diagrams which are capable of displaying relationship between pairs of the parameters are presented. Each morphological parameter is defined; the matrix diagram representation is presented with examples; the selection of the data is discussed; and the order of presentation of the diagrams is given. The matrix diagrams of the forty-five pairs of the ten morphological parmaters are then presented. Author

N74-11609*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD CONTRIBUTIONS TO THE LOS ALAMOS CONFERENCE ON TRANSIENT COSMIC GAMMA AND X-RAY SOURCES
Oct. 1973 101 p refs Conf. held at Los Alamos, N. Mex., 20-21 Sep. 1973
(NASA-TM-X-70507; X-660-73-315) Avail: NTIS HC $7.25
CSCL 03B

Conference papers, covering the origin and instrumentation for measuring the position of cosmic gamma ray bursts, are presented. Summaries cover gamma ray detectors, energy speectra, and the stellar super flare hypothesis. Author

N74-11610* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP-6 OBSERVATIONS OF THE ENERGY SPECTRA OF COSMIC GAMMA-RAY BURSTS
T. L. Cline and U. D. Desai *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 14 p refs (For availability see N74-11609 02-29)
CSCL 03B

The occurrence of intense, short bursts of 0.1 to 1.2 MeV cosmic gamma rays, recently found using multiple Vela satellites was confirmed with measurements from the IMP-6 satellite. Observations regarding times of occurrence, photon flux, and temporal and spectral characteristics of the bursts are outlined. In particular, since the IMP-6 instrument incorporates a hard X-ray detector with active particle rejection and full-time omnidirectional particle intensity monitoring, the results fully confirm and establish the hard X-ray or gamma-ray nature of the incident flux. Detailed differential energy spectra were obtained with the IMP-6 for six of the eight known events occurring during the March 1971 to September 1972 lifetime of the instrument. All of these are multiple-pulse events, with several seconds separation between distinct pulses of one or two seconds duration. The pulse spectra do not obey single-index power laws in energy, but can be represented by exponentials in photon flux throughout the 100 to 1200 KeV region. Author

N74-11611* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP-6 OBSERVATIONS OF SMALL-SIZED CANDIDATE COSMIC GAMMA-RAY BURSTS
T. L. Cline and U. D. Desai *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 5 p (For availability see N74-11609 02-29)
CSCL 03B

Data are reported that show observations made by IMP-6 may make it possible to detect a number of cosmic gamma ray bursts in addition to those previously cataloged. Selection criteria are based on consistent time scale and observable intensity only. In addition, a differential energy analyzer with simultaneous storage was used making it possible to search for intensity increases simultaneously in several channels. E.H.W.

N74-11612* Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
A DIRECTIONAL LOW ENERGY GAMMA-RAY DETECTOR c14
G. Morfill and G. F. Pieper *In* NASA. Goddard Space Flight Center Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 28 p refs (For availability see N74-11609 02-29)
CSCL 14B

The sensitivity of a directional gamma ray detector, which relies on blocking a source to determine its direction and energy spectrum, is calculated and compared to the more conventional well shaped shielded detectors. It is shown that such an anticollimator detection system provides a basis for measuring the celestial diffuse gamma ray background, gamma ray sources and bursts with good energy, angular, and time resolution, and that additionally the system is 20 to 50 times as sensitive as conventional detectors when compared on a per unit mass basis. Author

N74-11613* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANISOTROPIC DETECTOR SYSTEM FOR THE MEASUREMENT OF GAMMA-RAY SOURCE POSITION c14
J. I. Trombka, E. L. Eller, J. I. Vette, R. L. Schmadebeck, and F. W. Stecker *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 10 p refs (For availability see N74-11609 02-29)
CSCL 14B

Detection efficiencies of cylindrical detectors for various gamma ray photon angular distributions in the energy range from .10 MeV to 15 MeV are studied. It was found that a properly chosen cylindrical crystal can produce a significantly modulated count rate as a function of angle when rotated in the anisotropic flux. The studies further indicate that simple detector systems can be used on small satellites for the determination of a gamma ray source position. Results are outlined and extended to examine source resolution angles for a practical size detector. Author

N74-11614* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COOLING BLACK BODY: A MECHANISM FOR COSMIC GAMMA-RAY BURSTS
Reuven Ramaty and Jeffrey M. Cohen (Pennsylvania Univ.) *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 14 p refs (For availability see N74-11609 02-29)
CSCL 03B

An examination was made of black body emission as a possible radiation mechanism for cosmic ray bursts. It was suggested that black body radiation of variable temperature causes the bursts. Temperature variations are caused by cooling due to gamma ray emission. Author

N74-11615* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC SOFT GAMMA-RAY BURSTS AND THE STELLAR SUPER-FLARE HYPOTHESIS
F. W. Stecker and K. J. Frost *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 13 p refs (For availability see N74-11609 02-29)
CSCL 03B

Possible alternatives to the supernovae theory on the origin of cosmic ray bursts are examined. In particular, the possibility that these outbursts are simply giant versions of the X-ray burst typically seen in solar flares is investigated. It was suggested that the outbursts are caused by the bresstrahlung of electrons accelerated to high energies in a stellar flare event. E.H.W.

N74-11616* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTS FOR THE STUDY OF COSMIC GAMMA-RAY BURSTS
T. L. Cline and U. D. Desai *In its* Goddard Contrib. to the Los Alamos Conf. on Transient Cosmic Gamma and X-ray Sources Oct. 1973 14 p (For availability see N74-11609 02-29)
CSCL 03B

Several experiments are outlined which are designed for investigating cosmic gamma ray bursts; they form a research program that includes balloon experiments currently under development and satellite experiments proposed for future missions. The satellite proposals, in most cases, are either suggested for payloads that are presently defined as to experimental complement, or are for hypothetical spacecraft. Thus, these proposals at present serve to indicate, at least, the possible usefulness of various space missions for cosmic gamma-ray burst studies. Taken as a whole, this program of gamma ray burst

experiments should improve on the present observations of the temporal variations, size spectrum, energy spectra, polarizations, directional locations and distribution of source directions, each by several orders of magnitude of improved resolution or of dynamic range. Author

N74-11617*# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
DIFFERENTIAL ENERGY SPECTRA OF LOW ENERGY (LESS THAN 8.5 MeV PER NUCLEON) HEAVY COSMIC RAYS DURING SOLAR QUIET TIMES
D. Hovestadt, O. Vollmer, G. Gloeckler (Maryland Univ, College Park, Md.), and C. Y. Fan (Arizona Univ., Tucson, Ariz.) May 1973 15 p refs Sponsored in part by the Ger. Govt.
(Contract NAS5-11063; Grant NGR-21-002-224)
(NASA-CR-136081; MPI-PAE/Extraterr-84) Avail: NTIS HC $3.00 CSCL 03B

Explorer 47 satellite observations of carbon, oxygen, and heavier nuclei differential energy spectra below 8.5 MeV/nucleon are presented for solar quiet time periods. A dE/dx vs E method for particle identification and energy determination was used. The instrumentation telescope included an isobutane proportional counter, a surface barrier Si detector, and a cylindrical plastic scintillator anticoincidence shield. The observations were performed outside the bow-shock and in the ecliptic plane. Results show an anisotropy of about 25% at 22 degrees west of the sun with a C/O ratio of 0.5 supporting a solar origin. The low energy portions of the C and O spectra have steep negative slopes, and the corresponding power law is given. Peculiarities in the O spectrum are discussed. ERSO

N74-11618# Osservatorio Astronomico, Rome (Italy).
SOLAR PHENOMENA Monthly Bulletin, May 1973
Massimo Cimino May 1973 12 p
(PUBL-181) Avail: NTIS HC $3.00

Solar data for May 1973 are presented. Tables include: daily total areas of sunspot groups; heliographic position, classification and area of sunspot groups; longitudinal sunspot magnetic fields, and hours of K-line cinematographic patrol. ESRO

N74-11619# American Inst. for Research, Kensington, Md.
SPACE FORECASTING DATA PROCESSING SYSTEMS Final Report, 11 Dec. 1970 - 30 Jun. 1973
Jul. 1973 43 p refs
(Contract F19628-71-C-0069; AF Proj. 8666)
(AD-766767; AFCRL-TR-73-0531) Avail: NTIS CSCL 03/2

The Space Forecasting Data Processing Systems is part of a Research and Development (R and D) effort performed at Air Force Cambridge Research Laboratories (AFCRL) in conjunction with the Air Weather Service (AWS). This R and D project is an effort designed to receive, analyze, process and disseminate results of astrogeophysical data collected by a worldwide observational network. The computer programs developed are part of a large operational system executed on the Univac 1108 digital computer housed at Offutt Air Force Base, Omaha, Nebraska. The developed programs will process and analyze incoming data for operational as well as scientific use, and specifically attempt to relate pertinent solar phenomena to effects caused within the earth's atmosphere/ionosphere. Author (GRA)

N74-11620# Pennsylvania State Univ., University Park.
A STATISTICAL STUDY OF 5480 MICROWAVE SOLAR RADIO EVENTS Ph.D. Thesis
Fred L. Wefer Apr. 1973 319 p refs
(Grants Nonr-656(32); NSF GA-28122)
(AD-766078; SR-026) Avail: NTIS CSCL 03/2

A statistical study is made of the 5480 microwave solar radio events observed at The Pennsylvania State University Radio Astronomy Observatory (PSURAO) at radio frequencies of 10.7 GHz(2.80 cm. lambda), 2.70 GHz(11.1 cm. lambda), and 960 MHz(31.2 cm. lambda). The observations were made during the first six years of the PSURAO solar radio patrol program, and extend from solar activity minimum through the flat peak in solar activity cycle 20. The twelve event types in the PSURAO Classification System for microwave events are divided into two classes, primary events and secondary events. The primary events (SIMPLE, COMPLEX, GREAT BURST, PECULIAR and PRECURSOR) are events which are capable of high peak flux densities and large event energies. The secondary events (P.B.I., RISE, SPIKE, FLUCT., FALL, ABSORPTION and P.B.D.) are not generally capable of attaining these. Relationships between ten selected pairs of morphological parameters of SIMPLE events are studied with the aid of modified scatter diagrams called matrix diagrams. A total of ten approximate physical relationships are established. A number of additional relationships are shown which result from instrumental limitations on the morphological parameters. (Modified author abstract) GRA

N74-11089 Joint Publications Research Service, Arlington, Va.
COSMIC RAY RESEARCH
S. N. Vernov, G. P. Lyubimov, Ye. A. Chuchkov, and N. N. Kontor *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 175-189 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-11621* Universities Space Research Association, Charlottesville, Va.
HIGH PRESSURE PHYSICS AND PLANETARY INTERIORS
S. K. Runcorn, ed. Amsterdam North-Holland Publishing Co. 1972 224 p refs Repr. from Phys. Earth Planet. Interiors (Netherlands), v. 6, nos. 1-3, 1972 p 1-209 Conf. held at Houston, Tex., 1-3 Mar. 1972; sponsored by the Lunar Sci. Inst.
(Contract NSR-09-051-001)
(NASA-CR-135994; Contrib-89; ISBN-0-7204-0269-7; ISBN-0-4-44-10458-5; LC-72-93498) Copyright. Avail: American Elsevier Publishing Co., Inc. 52 Vanderbilt Avenue, New York, N. Y. 10017 CSCL 03B

The proceedings of a conference on high pressure physics and planetary interiors are reported. The purpose of the conference was to obtain the views of experimental physicists working in the fields of solid state physics, quantum mechanics, geophysics, and planetary astronomy on the structure of the planets. The internal structure of the major planets are analyzed by equations of state which are intermediate between gas laws applying to stellar interiors and the solids of high molecular weight and complex crystal structure of the interior of the terrestrial planets. For individual titles, see N74-11622 through N74-11654.

N74-11622* Yale Univ. Observatory, New Haven, Conn.
HYDROGEN PLANETS AND HIGH-PRESSURE PHYSICS
Rupert Wildt *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 1-4 refs (For availability see N74-11621 02-30)
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A theoretical discussion of the composition of the major planets is presented. A simplistic physical model of the giant planets is described. The conclusions of several theoretical explanations of the planetary structure are explained. Curves are developed to show the mass-radius relation for zero temperature spheres of various chemical compositions. The density of isothermal atmospheres of hydrogen as a function of the elevation above a surface of solid hydrogen. Author

N74-11623* Lunar Science Inst., Houston, Tex.
PLANETS AND SATELLITES: A SURVEY OF FUNDAMENTAL FACTS
Zdenek Kopal *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 5-9 refs (For availability see N74-11621 02-30)
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An account of the fundamental properties of the planets of the solar system and of their satellites including their masses, dimensions and distances is presented. The observational uncertainty in present knowledge of planetary masses and

dimensions (or mean densities) is discussed critically. The fact is pointed out that the initial scale of the solar system may have differed appreciably from the present one. Observed phenomena which can furnish empirical information on the internal structure of the planetary globes will also be reviewed.

N74-11624* Florida Univ., Gainesville. Dept. of Physics and Astronomy.

NONTHERMAL RADIO OBSERVATIONS OF THE MAJOR PLANETS

Alex G. Smith, R. J. Leacock, T. D. Carr, G. R. Lebo, and C. N. Olsson *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 10-16 refs Sponsored in part by NSF and Res. Corp. of New York (For availability see N74-11621 02-30)

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Seventeen years of observations have shown that Jupiter is a complex and intriguing source of emission over the entire radio spectrum accessible from the ground. The observations indicate the presence of intense radiation belts and a strong magnetic field inclined to the axis of rotation. At decametric wavelengths, several remarkably powerful sources are correlated with the rotation of the planet and the orbital motion of the satellite Io. Longer-term variations of these sources may be associated with the sunspot cycle, with Jupiter's orbital motion, or with changes in the internal structure of the planet. There is at most marginal evidence of nonthermal emission from Saturn, and as yet no evidence for such radiation from Uranus or Neptune. Author

N74-11625* Liverpool Univ. (England).

A SURVEY OF DYNAMICAL DATA FOR THE MAJOR PLANETS AND SATELLITES

P. J. Message *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 17-20 refs (For availability see N74-11621 02-30)

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Representative values for the masses and sizes of the major planets and their larger satellites are given. These quantities are well determined for most of the planets, with the notable exception of Pluto, and the coefficient in the gravitational field is in most cases known well enough to see that the equilibrium value of the oblateness agrees with the observed value to first approximation. The sizes of the larger satellites only may be measured directly, and, in the case of the smaller bodies, only probable limits for the sizes can be given, inferred from the observed magnitudes. The determination of the mass of a satellite usually depends on the existence of a near-commensurability with another, the perturbation of which is augmented so as to be more easily detected in the observations. Author

N74-11626* Florida Univ., Gainesville. Dept. of Physics and Astronomy.

JUPITER'S DECAMETRIC ROTATION PERIOD AND THE SOURCE-A EMISSION BEAM

Thomas D. Carr *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 21-28 refs Sponsored in part by NSF (For availability see N74-11621 02-30)

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Determinations of the average decametric rotation period for the planet Jupiter are discussed. Mean rotation periods for a twelve year span are plotted as a function of the mean epochs. Two lesser peaks in the longitude histograms were resolved in addition to the main peak. The three peaks, which are believed to result from emission beams oriented in different directions relative to the corotating magnetic field of the planet, are designated Sources A, B, and C in decreasing order of prominence at frequencies in the vicinity of 18 MHz. Author

N74-11627* Bureau des Longitudes, Paris (France).

A SYSTEM OF PLANETARY MASSES AND RELATED QUANTITIES

Jean Kovalevsky *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 29-35 refs (For availability see N74-11621 02-30)

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After a short presentation of the methods used in the determinations of the masses of planets, the recent results for each planet are discussed and the best values available are presented. A similar discussion is given for the determination of the dynamical flattening of these planets, and, finally, a system of masses and mean densities of the planets is proposed. Author

N74-11628* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THERMAL RADIO EMISSION FROM JUPITER AND SATURN

S. Gulkis and R. Poynter *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 36-43 refs (For availability see N74-11621 02-30)

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Microwave brightness temperature calculations have been carried out for a number of model atmospheres for Jupiter and Saturn. The models considered are characterized by helium to hydrogen number mixing ratios which range from 0 to 0.2. Gaseous ammonia is assumed to be a trace constituent in all the models. The ammonia abundance below the (NH3) cloud level is a free parameter which is determined by comparing the observed thermal spectrum of Jupiter and the total spectrum of Saturn with the model calculations. The theoretical microwave spectra corresponding to those models in which the ammonia abundance is that expected from an atmosphere containing a solar abundance of elements are found to be in generally good agreement with the observations. This result is shown to be nearly independent of the helium to hydrogen ratio for the models considered. There is no evidence at this time that a non-thermal component contributes to Saturn's microwave spectrum. Author

N74-11629* California Univ., Livermore. Lawrence Livermore Lab.

ISENTROPIC COMPRESSION OF FUSED QUARTZ AND LIQUID HYDROGEN TO SEVERAL MBAR

R. S. Hawke, D. E. Duerre, J. G. Huebel, R. N. Keeler, and H. Klapper *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 44-47 refs (For availability see N74-11621 02-30)

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Models of the major planets are in part based on the equations of state of very compressible materials such as hydrogen and helium. A technique of isentropically compressing soft material to several Mbar and some preliminary results on fused quartz (silicon dioxide) and liquid hydrogen is described. Quartz was found to be an electrical non-conductor up to 5 Mbar and has a volume of about 0.15 cubic centimeters per gram at that pressure. Liquid hydrogen was found to have a volume of about 1 cm3/g at a pressure of about 2 Mbar. It was not determined if it was transformed into a metal. Author

N74-11630* Princeton Univ., N.J.

ELECTRICAL CONDUCTIVITY OF CONDENSED MOLECULAR HYDROGEN IN THE GIANT PLANETS

R. Smoluchowski *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 48-50 refs (For availability see N74-11621 02-30)

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Theoretical interpretation of several phenomena concerning Jupiter and Saturn depends upon the electrical conductivity of molecular hydrogen which, according to present models, forms the outermost layer of both planets. The layer starts at the transition pressure between the metallic and the molecular form of hydrogen, that is around 1 Mbar, and extends to the outside limits of the atmosphere. Whether at the highest pressures (and temperatures) this layer is a solid or a dense fluid is not certain. In any case, the fluid is in supercritical condition so that there is only a gradual transition from dense liquid to a gaseous form. The two theories which require specific values of the conductivity of the condensed molecular hydrogen are those pertaining to the generation of a magnetic field in the liquid hydrogen rather than in the deep metallic interior (HIDE, 1967), and those concerned with the electromagnetic coupling and exchange of angular momentum between the liquid core and the solid molecular hydrogen mantle. Author

N74-11631* California Univ., Livermore. Lawrence Livermore Lab.

QUANTUM STATISTICAL MECHANICS OF DENSE PARTIALLY IONIZED HYDROGEN c06

H. E. Dewitt and F. J. Rogers *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 51-59 refs Sponsored by AEC (For availability see N74-11621 02-30)
(Grant NGL-16-001-043)
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The theory of dense hydrogen plasmas beginning with the two component quantum grand partition function is reviewed. It is shown that ionization equilibrium and molecular dissociation equilibrium can be treated in the same manner with proper consideration of all two-body states. A quantum perturbation expansion is used to give an accurate calculation of the equation of state of the gas for any degree of dissociation and ionization. The statistical mechanical calculation of the plasma equation of state is intended for stellar interiors. The general approach is extended to the calculation of the equation of state of the outer layers of large planets. Author

N74-11632* California Univ., Livermore. Lawrence Livermore Lab.
CORRELATION OF THEORY AND EXPERIMENT FOR HIGH-PRESSURE HYDROGEN c06

William G. Hoover, Marvin Ross, C. F. Bender, Forrest J. Rogers, and R. J. Olness *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 60-64 refs Sponsored by AEC (For availability see N74-11621 02-30)
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Recent quantum calculations and high-pressure experiments both agree on the magnitude of the forces with which hydrogen molecules interact. The calculated forces have to be determined in two steps: the repulsion is determined by Hartree-Fock calculations while the attraction is deduced semiempirically. The experimental forces are inferred from recent data on hydrogen shockcompressed to 214 kbar. The agreement indicates the usefulness of a pair-potential description of dense hydrogen and suggests, using potentials consistent with both theory and experiment, that pressures of at least 1.7 Mbar will be required to make metallic hydrogen. The expected lifetime of the metal at atmospheric pressure is very short. Author

N74-11633* Texas Univ., Austin. Dept. of Astronomy.
THERMODYNAMICS OF HYDROGEN-HELIUM MIXTURES AT HIGH PRESSURE AND FINITE TEMPERATURE c33

W. B. Hubbard *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 65-68 refs (For availability see N74-11621 02-30)
(Grant NSF GP-19667)
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A technique is reviewed for calculating thermodynamic quantities for mixtures of light elements at high pressure, in the metallic state. Ensemble averages are calculated with Monte Carlo techniques and periodic boundary conditions. Interparticle potentials are assumed to be coulombic, screened by the electrons in dielectric function theory. This method is quantitatively accurate for alloys at pressures above about 10 Mbar. An alloy of equal parts hydrogen and helium by mass appears to remain liquid and mixed for temperatures above about 3000 K, at pressures of about 15 Mbar. The additive volume law is satisfied to within about 10%, but the Gruneisen equation of state gives poor results. A calculation at 1300 K shows evidence of a hydrogen-helium phase separation. Author

N74-11634* Military Academy, West Point, N.Y.
PHASE EQUILIBRIA IN FLUID MIXTURES AT HIGH PRESSURES: THE He-CH4 SYSTEM c06

W. B. Streett, A. L. Erickson, and J. L. E. Hill *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 69-77 refs Sponsored in part by AROD (For availability see N74-11621 02-30)
(NASA Order W-13142)
Copyright. CSCL 07D

An experimental study of phase equilibria in the He-CH4 system was carried out over the temperature range 95 to 290 K and at pressures to 10,000 atm. The experimental results consist of equilibrium phase composition for twenty-eight isotherms in the region of coexistence of two fluid phases, together with the pressure-temperature trace of the three-phase boundary at which a CH4-rich solid phase is in equilibrium with the two fluid phases. The system exhibits a fluid-fluid phase separation which persists to temperatures and pressures beyond the range of this experiment. These results, together with those recently obtained for other binary systems, provide information about the form of phase diagrams for binary gas mixtures in the region of pressure induced phase transitions at high pressures. These findings are relevant to problems of deep atmosphere and interior structures in the outer planets. Author

N74-11635* Los Alamos Scientific Lab., N.Mex.
EQUATION OF STATE AND PHASE DIAGRAM OF DENSE HYDROGEN c06

Gerald I. Kerley *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 78-82 refs (For availability see N74-11621 02-30)
Copyright. CSCL 07D

The equation of state of hydrogen was calculated for specific volumes ranging from 0.01 to 0.0001 cm3/mole and for temperatures ranging from 200 to 1 million K. Three phases are considered: the molecular solid, the metallic solid and the fluid. Chemical equilibrium between molecules, atoms, ions and electrons is considered in calculating the properties of the fluid phase. Transitions between the three phases will be discussed. The triple point, where the three phases coexist, is calculated to occur at 2.3 Mbar and 1679 K. At higher temperatures and pressures, the molecular solid is unstable. Author

N74-11636* Ohio State Univ., Columbus. Dept. of Physics.
GROUND STATE ENERGY OF SOLID MOLECULAR HYDROGEN AT HIGH PRESSURE c26

C. Ebner and C. C. Sung *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 83-90 refs (For availability see N74-11621 02-30)
Copyright. CSCL 20L

The present status of the theoretical equation of state of solid molecular hydrogen is reviewed. Different quantum mechanical calculations by several groups lead to results which generally agree with each other but which disagree systematically with the measured pressure-volume curve at pressures larger than about 3000 atm. A new calculation of this curve is presented including the effect of the anisotropic interaction between H2 molecules within a completely quantum-mechanical formalism. The results show that inclusion of this interaction removes the discrepancy between theory and experiment at high pressures and that a quantum-mechanical treatment is necessary to realize its full effect. Author

N74-11637* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EVOLUTIONARY CALCULATION OF JUPITER

Allen S. Grossman (Iowa State Univ.), Harold Graboske (Calif. Univ., Livermore), James Pollack, Ray Reynolds, and Audrey Summers *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 91-98 refs (For availability see N74-11621 02-30)
(Grant NSF GP-25949)
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A preliminary evolutionary calculation was made for a stellar object of 0.001 solar mass composed of pure hydrogen. The star undergoes the gravitational contraction from an initial radius of 35 times the present radius of Jupiter (R sub Jup). The interior is assumed to be in convective equilibrium throughout the evolution. The evolution has been followed for 10 to the ninth power y at which time R = 2.8 R sub Jup and the central temperature is 18000 K. The log of the luminosity (in units of solar luminosity) and effective temperature due to the internal energy sources are log L/solar luminosity = -9.0 and log T sub e = 1.77. Author

N74-11638* Meteorological Office (Gt. Brit.). Geophysical Fluid Dynamics Lab.
JUPITER'S GREAT RED SPOT REVISITED

R. Hide *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 99 refs (For availability see N74-11621 02-30)
Copyright. CSCL 03B

On the original Taylor column theory of Jupiter's Great Red

Spot, the fixed latitude of the Spot is taken to imply that the Taylor column in Jupiter's atmosphere is associated with a disturbance such as a topographic feature of the surface Q underlying the atmosphere. The alternative suggestion that the Taylor column is produced by a solid raft floating at depth in the atmosphere is somewhat easier to reconcile with the approximately 10s difference between the respective rotation periods P sub S and P sub R of the Red Spot and of the radio sources, but it does not account so readily for the fixed latitude of the Spot unless it can be shown that the raft is in stable equilibrium under the north-south components of the dynamical forces, including wind effects, acting upon it. A slight wavering of the upper end of the Taylor column relative to the lower end could account at least in part for the most rapid variations in P sub S, but the slow large-amplitude variations in P sub S must reflect changes in the longitudinal motion of either the surface Q or of the raft. By generalizing the Proudman-Taylor theorem to the case of a non-homogeneous fluid it is shown that the Taylor column theory does not imply very special and therefore unlikely horizontal and vertical temperature variations in Jupiter's atmosphere, thus refuting a widely-held belief to the contrary.
Author

N74-11639* Newcastle-upon-Tyne Univ. (England). School of Physics.
EVIDENCE ON THE DEEPER PLANETARY INTERIORS
S. K. Runcorn *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 100-102 refs (For availability see N74-11621 02-30)
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Various theories are evaluated that have arisen in attempts at determining the physics of planetary interiors by observations from the gravitational field and radiation from the surface. It is concluded that there appears great scope in obtaining data from planetary fields which will provide not only evidence of static structure but also of dynamic behavior and which will produce parameters of the solid state properties of their deep interiors.
D.L.G.

N74-11640* Illinois Univ., Urbana. Dept. of Physics.
THE ELASTIC ENERGY AND CHARACTER OF QUAKES IN SOLID STARS AND PLANETS
David Pines and Jacob Shaham *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 103-115 refs (For availability see N74-11621 02-30)
(Grant NSF GP-25855)
CSCL 03B

The quadrupolar mechanical energy of a rotating axially symmetric solid planet (with or without a liquid interior) is calculated using methods previously developed for neutron stars in which an elastic reference tensor is introduced to describe the build-up of elastic energy in the star. The basic parameters of the theory (the gravitational energy A and elastic energy B) depend upon the internal structure of the planet and may be calculated from specific planetary models. Explicit expressions are obtained for the Love numbers, and for the planetary wobble frequency. The theory provides a simple relationship between changes in shape or axis of figure of the planet and elastic energy release. The theory is extended to describe the Earth by taking into account isostasy, triaxiality and the observed lithospheric configuration.
Author

N74-11641* California Inst. of Tech., Pasadena. Seismological Lab.
THE LUNAR INTERIOR
Don L. Anderson and Robert L. Kovach *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 116-122 refs (For availability see N74-11621 02-30)
(Grants NGL-05-002-069; NGL-05-020-232)
(Contrib-2122) Copyright. CSCL 03B

The compressional velocities are estimated for materials thought to be important in the lunar interior and compared with lunar seismic results. The lower lunar crust has velocities appropriate for basalts or anorthosites. Anorthosite is preferred if lunar basalts result from a small degree of partial melting. The high velocities associated with the uppermost mantle imply high densities and a change to a lighter assemblage at depths of the order of 120 km. Ca- and Al-rich minerals are important components of both the lower crust and the upper mantle. Most of the moon may have accreted from refractory material rich in Ca, Al, U, and the rare-earth elements. The important mineral of the upper mantle is garnet; possible accessory minerals are kyanite, spinel and rutile. If the seismic results stand up, the high-velocity layer in the moon is more likely to be a high-pressure form of anorthosite than eclogite, pyroxenite, or dunite.
Author

N74-11642* Minnesota Univ., Minneapolis.
THE ORIGIN AND CHEMICAL COMPOSITION OF THE EARTH'S CORE
V. Rama Murthy and T. Hall *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 123-130 refs (For availability see N74-11621 02-30)
(Grant NSF GA-14950)
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The process of core formation in the earth is subject to the constraints that it be nearly simultaneous with accretion and yet occur in a manner that the mantle retains radiogenic Xe-129 produced from the extinct radioactivity of I-129 with a half life of 17.6 million y. From these constraints, it appears that the only feasible mechanism is the segregation of an Fe-FeS melt. Trace element abundances in major classes of meteorites and the silicate fractions of the earth show that not only there is a high depletion of sulphur in the crust and the mantle, but that it is even more highly depleted than the rare gases, water and the halogens. From the nature of this depletion pattern and the fact that any model of accretion of the earth will necessarily produce an Fe-FeS melt, it is concluded that the light element in the core is largely sulphur with minor amounts of carbon. A consequence of this mode of core formation is found to be the availability of K-40 radioactive heat production in the liquid core, estimated at about 10 to the 19th power erg/s at the present time.
Author

N74-11643* Sydney Univ. (Australia).
COMPRESSIBILITY AND PLANETARY INTERIORS
K. E. Bullen *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 131-135 refs (For availability see N74-11621 02-30)
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Important confirmations that the Earth's inner core is solid have recently come from analyses of records of free Earth oscillations and from the apparent detection of the seismic phase PKJKP. Corresponding support is given to the theory which supplied the primary evidence for rigidity in the inner core. This theory requires the incompressibility and its gradient with respect to the pressure p to vary fairly smoothly with p inside planets, and supplies a potent restriction on the allowable variations of particular physical properties inside parts of planetary interiors. The theory is at present principally applicable to the Earth and Venus. The paper reviews some of the principal implications.
Author

N74-11644* California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
SHOCKWAVE DETERMINATION OF THE SHEAR VELOCITY AT VERY HIGH PRESSURES
Orson L. Anderson *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 136-140 refs (For availability see N74-11621 02-30)
(Grants NGL-05-007-330; AF-AFOSR-2093-71)
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A shock wave experiment is described for confirming changes in density, from seismic interpretation, for determining the properties of planet interiors. The experiment focuses on the problem of measurements in a pressure region, where the shear velocity tends to vanish, or become very small. Pressure-sensitive lattice stability, and the equations for an atomic model of the NaCl lattice are discussed along with the particle velocity shock technique.
F.O.S.

N74-11645* Bristol Univ. (England). H. H. Wills Physics Lab.
CALCULATIONS OF ELECTRICAL TRANSPORT PROPERTIES OF LIQUID METALS AT HIGH PRESSURES c17
R. Evans and Ashok Jain *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 141-145 refs

(For availability see N74-11621 02-30)
Copyright. CSCL 11F

It is shown how the usual nearly-free-electron model for the electrical resistivity of simple liquid metals can be extended to the case of liquid transition metals such as iron. A simple prescription is given for calculating the resistivity at different densities and temperatures. As an application and example of the method, calculations on liquid iron at different densities were carried out and the resistivity of molten iron in the earth's outer core is estimated. The effects of alloying iron with other elements are also considered. The calculated conductivity of the outer core is well within the limit required for the dynamo model of the geomagnetic field and agrees well with some recent shock wave data. Author

N74-11646* California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics and Dept. of Planetary and Space Science.

LATTICE MODEL CALCULATION OF ELASTIC AND THERMODYNAMIC PROPERTIES AT HIGH PRESSURE AND TEMPERATURE c33

Harold H. Demarest, Jr. *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 146-153 refs (For availability see N74-11621 02-30)
(Grant AF-AFOSR-2093-71)
(Publ-1087) Copyright. CSCL 20M

The elastic constants and the entire frequency spectrum were calculated up to high pressure for the alkali halides in the NaCl lattice, based on an assumed functional form of the inter-atomic potential. The quasiharmonic approximation is used to calculate the vibrational contribution to the pressure and the elastic constants at arbitrary temperature. By explicitly accounting for the effect of thermal and zero point motion, the adjustable parameters in the potential are determined to a high degree of accuracy from the elastic constants and their pressure derivatives measured at zero pressure. The calculated Gruneisen parameter, the elastic constants and their pressure derivatives are in good agreement with experimental results up to about 600 K. The model predicts that for some alkali halides the Grunesen parameter may decrease monotonically with pressure, while for others it may increase with pressure, after an initial decrease. Author

N74-11647* Rochester Univ., N.Y. Dept. of Geological Sciences.

DISPROPORTIONATION OF Fe2SiO4 TO 2FeO PLUS SiO2 AT PRESSURES UP TO 250kbar AND TEMPERATURES UP TO 3000 C c06

William A. Bassett and Li-Chung Ming *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 154-160 refs (For availability see N74-11621 02-30)
(Grant NSF GA-25718)
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A sample of Fe2SiO4 (spinel) at approximately 250 kbar in a diamond anvil press was heated to approximately 3000 C for a duration of some ms using a focused light beam from a pulsed ruby laser. After quenching and unloading, X-ray diffraction patterns indicated that the portion of the sample that had been heated contained wustite and stishovite. A sample of Fe2SiO4 (fayalite) at approximately 200 kbar in a diamond anvil press has been heated to 800 C for 20 min in a furnace. After quenching and unloading, the sample was found to have concentric zones with the fayalite phase at the lowest pressure, the spinel phase at the intermediate pressure, and a dark region at the center where the pressure was highest. An X-ray diffraction pattern of the dark central region indicated the presence of wustite. A microprobe analysis of a sample produced by a similar procedure indicated that SiO2 is apparently evolved along with wustite but is not sufficiently crystalline to be detected by X-ray diffraction. Author

N74-11648* Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

PARTITIONING OF POTASSIUM BETWEEN SILICATES AND SULPHIDE MELTS: EXPERIEMENTS RELEVANT TO THE EARTH'S CORE

Kenneth A. Goettel *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 161-166 (For availability see N74-11621 02-30)
(Grant NGL-22-009-521)
Copyright. CSCL 03B

The partitioning of potassium between roedderite, K2Mg-5Si12O30 and an Fe-FeS melt was investigaged at temperatures about 40 C above the Fe-FeS eutectic. Roedderite was considered a prime candidate for one of the potassium-bearing phases in the primitive earth because roedderite and merrihueite are the only two silicates containing essential potassium which have been identified in stony meteorites. A mean K2S/FeS weight ratio of (3.340 + or - 0.015) x 0.001 was determined in these experiments; a K2S/FeS weight ratio of about 0.01 would be sufficient to extract all potassium in a chondritic earth into the core. Application of these results to a primitive chondritic earth is discussed and it is concluded that extraction of most of the earth's potassium into the Fe-FeS core would occur under the conditions in the early earth. Author

N74-11649* California Univ., Los Angeles. Dept. of Planetary and Space Science and Inst. of Geophysics and Planetary Physics.

PRELIMINARY MAPPING OF THE LUNAR MAGNETIC FIELD

Paul J. Coleman, Jr., Christopher T. Russell, Lawrence R. Sharp, and Gerald Schubert *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 167-174 refs (For availability see N74-11621 02-30)
Copyright. CSCL 03B

Magnetic field measurements made with the Apollo 15 subsatellite established the existence of remanent magnetization over much of the Moon's surface. The major features of the structure of the measured remanent field are apparently associated with large craters, the most apparent detected to date being that in the vicinity of the Van de Graaff crater. A preliminary contour map of relative magnetic intensity was produced for a limited region of the Moon. A high resolution plot of the Van de Graaff region was constructed from vector data in an attempt to locate the source of the largest feature observed. Author

N74-11650* California Univ., Berkeley. Dept. of Geology and Geophysics.

MELTING OF IRON BY SIGNIFICANT STRUCTURE THEORY c17

David A. Leppaluoto *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 175-181 refs (For availability see N74-11621 02-30)
(Grant NSF GA-1682)
Copyright. CSCL 11F

From Eyring's method of significant structures, a partition function is derived for liquid iron. The solid at high temperature is described in the Einstein approximation. Magnetic and electronic contributions to the thermodynamic properties of both the liquid and solid phases are considered. The model is compatible with properties (thermal expansion, compressibility, heat capacity, entropy of melting, and volume change on melting) at one atm. The melting temperature at high pressure is found by satisfying the requirement that the Gibbs free energies of the liquid and solid phases are equal at the melting temperature. Under conditions at the earth's core-mantle boundary, the melting temperature of iron is greater than approximately 5000 K, and under inner-outer core conditions the melting temperature is greater than approximately 7000 K. These estimates are consistent with the Lindemann melting law, but not with the Kraut-Kennedy melting law. Author

N74-11651* Newcastle-upon-Tyne Univ. (England).

THE PRESENT THERMAL STATE OF THE TERRESTRIAL PLANETS

D. C. Tozer *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 182-197 refs (For availability see N74-11621 02-30)
Copyright. CSCL 03B

The thermal state of bodies is discussed as an aspect of their internal dynamics for bodies of roughly meteoritic composition in the range of sizes of planetary objects. The rheological behaviour of planetary material is assumed to be represented by a Newtonian viscosity varying exponentially with temperature, and only the consistency of this assumption with the elastic view of the planets

is considered. It is shown that for the whole range of physically plausible values of the material parameters, the temperature distribution associated with a solution to the problem of internal dynamics for bodies with external radii larger than about 800 km departs significantly from that predicted on conduction theory arguments. For bodies in the range of sizes of the terrestrial planets, the viscosity-temperature relationship plays a dominant role in setting the absolute temperature of the central regions. Author

N74-11652* Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
VISCOUS STRATIFICATION OF THE EARTH AND CONVECTION
Walter M. Elsasser *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 198-204 refs (For availability see N74-11621 02-30)
Copyright. CSCL 03B

The shallow model of the earth's mantle is discussed along with a variety of geophysical arguments for its correctness and against the existence of deep convection. The main agrument is summarized in the proposal that the astheno sphere is less viscous (by a factor of 10 to 100) than has generally been assumed. In this shallow model, the return flow is essentially through the asthenosphere. The dynamical agent is the steep temperature gradient in the upper mantle. Speculations as to the historical variation of this gradient are advanced. The effects on the model of a nonuniform earth aggregation are considered and shown to favor shallow convection as well as a top convective layer (lithosphere plus asthenosphere) whose depth increases slowly over the earth's life, leading to a tectonic activity that increases gradually with time. Author

N74-11653* Meteorological Office (Gt. Brit.). Geophysical Fluid Dynamics Lab.
VISCOSITY OF THE EARTH'S CORE
R. Hide *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 205 refs (For availability see N74-11621 02-30)
Copyright. CSCL 03B

Estimates of the coefficient of kinematical viscosity nu of the earth's liquid metallic core that are given in the geophysical literature range from approximately 0.001 sq cm/s, the viscosity of molten iron at ordinary pressures, to approximately less than 10 to the 8th power sq cm/s, based on the observation that compressional waves traverse the core without suffering serious attenuation. Bumps on the core-mantle boundary with typical horizontal dimensions up to a few thousand km and vertical dimensions h of a few km would produce the topographic coupling between the core and mantle that is evidently implied by the observed decade variations in the length of the day (unless the coupling is due to the presence of rapidly fluctuating magnetic fields in the core). Author

N74-11654* Sheffield Univ. (England). Dept. of Physics.
TRANSPORT PROPERTIES OF LIQUID METAL HYDROGEN UNDER HIGH PRESSURES c17
R. C. Brown and N. H. March *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 206-209 refs (For availability see N74-11621 02-30)
Copyright. CSCL 11F

A theory is developed for the compressibility and transport properties of liquid metallic hydrogen, near to its melting point and under high pressure. The interionic force law is assumed to be of the screened Coulomb type, because hydrogen has no core electrons. The random phase approximation is used to obtain the structure factor S(k) of the system in terms of the Fourier transform of this force law. The long wavelength limit of the structure factor S(o) is related to the compressibility, which is much lower than that of alkali metals at their melting points. The diffusion constant at the melting point is obtained in terms of the Debye frequency, using a frequency spectrum analogous with the phonon spectrum of a solid. A similar argument is used to obtain the combined shear and bulk viscosities, but these depend also on S(o). The transport coefficients are found to be about the same size as those of alkali metals at their melting points. Author

N74-11655 Stanford Univ., Calif.
ORBIT DETERMINATION FOR A WEATHER OCCULTATION SATELLITE Ph.D. Thesis
Angus Raymond Morrison 1973 200 p
Avail: Univ. Microfilms Order No. 73-14946

The orbit determination aspects of a weather satellite experiment using ratio wave measurements between two satellites in almost identical, nearly circular orbits are discussed. Although launched together, the satellites are given a slight relative drift which results in the ray between them occultating the earth's atmosphere after a period of approximately three weeks. This occultation technique is quite similar to the 1965 Mariner mission which measured the atmospheric density of Mars. Prior to occultation, the range from satellite to satellite is monitored by an onboard measurement system with an absolute accuracy of 1/2 meter and a relative accuracy of 3 cm. A mathematical model is formulated incorporating both short period and long period fluctuations in the satellites' relative position due to the geopotential air drag, and radiation pressure. Dissert. Abstr.

N74-11656 Carnegie-Mellon Univ., Pittsburgh, Pa.
EVOLUTION OF THE ORBITAL ELEMENTS IN GEOCENTRIC ORBITS OF HIGH ECCENTRICITY BY NON-NUMERIC COMPUTATION Ph.D. Thesis
Ramaswamy Sridharan 1973 387 p
Avail: Univ. Microfilms Order No. 73-13941

Geocentric orbits of high eccentricity are of considerable interest for the study of the magnetopause, earth's magnetic tail, and transition phenomena. Very critical to these missions is the question of the lifetime of the satellite. The evolution of the height of perigee with time must be such that the satellite stays above the earth's atmosphere for as long as possible. A higher-order theory is developed for the evolution of orbital elements for initial orbital eccentricities up to 0.95. Reliable estimates for the orders of magnitude of higher-order terms are set up. The development of the theory is automated by the use of symbolic integration on a digital computer. Effects of earth's oblateness are also included. The final formulae were encoded into a program to compute the evolution of elements. Several realistic examples are treated, illustrating the good agreement between the theory and numerical integration. Dissert. Abstr.

N74-11657*# Martin Marietta Corp., Denver, Colo. Space Navigation on Technology Section.
SIMULATED TRAJECTORIES ERROR ANALYSIS PROGRAM, VERSION 2. VOLUME 2: PROGRAMMER'S MANUAL Final Report
E. D. Vogt, G. L. Adams, M. M. Working, J. B. Ferguson, and M. R. Bynum Mar. 1971 623 p
(Contract NAS5-11795)
(NASA-CR-132864; MCR-71-4-Vol-2) Avail: NTIS HC $33.25 CSCL 22C

A series of three computer programs for the mathematical analysis of navigation and guidance of lunar and interplanetary trajectories was developed. All three programs require the integration of n-body trajectories for both interplanetary and lunar missions. The virutal mass technique is used in all three programs. The user's manual contains the information necessary to operate the programs. The input and output quantities of the programs are described. Sample cases are given and discussed. Author

N74-11658# Joint Publications Research Service, Arlington, Va.
GAMMA ASTRONOMY
A. Galper and B. Luchkov 30 Oct. 1973 13 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 10, 1972 p 120-125
(JPRS-60403) Avail: NTIS HC $3.00

Gamma astronomy is described along with the instruments used in its investigation and results achieved by Soviet and American scientists. Author

N74-11659*# Kanner (Leo) Associates, Redwood City, Calif.
A METHOD FOR STUDYING THE TURBULENCE OF INTERSTELLAR MATTER
S. VonHoerner Washington NASA Nov. 1973 70 p refs Transl. into ENGLISH from Z. Astrophys. (Heidelburg), V. 30, 1951 p 17-64

(Contract NASw-2481)
(NASA-TT-F-15169) Avail: NTIS HC $5.50 CSCL 03B

A general statistical method for testing the spectral law of turbulence on measured radio velocities of interstellar gases is developed and applied to the Orion Nebula. The validity of Kolmogoroff's spectral law can be checked and, if confirmed, permits conclusions regarding the thickness or density of the nebula. The spectral law proves to be valid for the Orion Nebula, but with a constant factor which has a higher value in the central region than in the rest of the nebula. Dust density is found to be about 10 to the 22nd power grams percubic centimeter. This spectral law does not agree with measured line widths; deviation from isotropic steady-state turbulence must be assumed, at least for very small regions. Author

N74-11660*# Scripta Publishing Corp., Washington, D.C.
TWO POSSIBLE OBJECTS OF SEARCHES FOR HIGHLY DEVELOPED CIVILIZATIONS
G. I. Pokrovskiy NASA Aug. 1973 6 p refs Transl. into ENGLISH from Priroda (USSR), no. 6 p 97-98
(Contract NASw-2484)
(NASA-TT-F-15059) Avail: NTIS HC $3.00 CSCL 03B

The hypothesis for the possibility of life in other parts of the solar system is investigated. The concept of the closed planetary system is described. The speculation is made that such a closed system may exist in separate constellations Taurus and Monoceros. Author

N74-11661# Toronto Univ. (Ontario).
MEASUREMENT OF TURBULENCE INPUTS FOR V/STOL APPROACH PATHS IN A SIMULATED PLANETARY BOUNDARY LAYER
B. Etkin, G. W. Johnston, and H. W. Teunissen Jul. 1973 97 p refs
(Contract F33615-73-C-3013)
(UTIAS-189) Avail: NTIS HC $7.00

A study relating to the prediction of V/STOL flight path perturbations during steep landing descents was completed. The possibility of utilizing turbulence correlation data accummulated by means of fixed survey probes in a simulated planetary boundary layer model to predict the aircraft response is discussed. It is shown that this technique although necessarily limited in certain respects, represents an excellent starting point for more rigorous aircraft studies which may eventually be required. A large number of fixed probe hot wire correlation measurements of the turbulent velocity components were completed with a scaled model of the planetary boundary layer. The majority of these measurements were confined to a mean velocity power law variation of n = 0.16 with limited turbulence data also taken with n = 0.35. The feasibility of extending the present techniques with a more sophisticated moving hot wire turbulence probe was studied. A specific moving probe design concept has been examined and a first costing estimate developed. Author

N74-11662# Mons Univ. (Belgium). Dept. d'Astrophysique.
COMPUTER PROGRAM FOR HYDROGEN SPECTRAL LINES IN HOT STARS [PROGRAMME DE CALCUL DES RAIES DE L'HYDROGENE DANS LES ETOILES CHAUDES]
A. Delcroix Mar. 1973 86 p refs In FRENCH
(Commun-34) Avail: NTIS HC $6.50

A computer program for the analysis of hot hydrogen spectrum expressed in flux units in the 800 to 20,000 A range was described assuming the validity of local thermodynamic equilibrium hypothesis and taking into account the hydrogen lines, excluding all other elements. The files used are presented as well as error detection codes generated from the program. The adaptation of this program to other than Burroughs B-5500 computers is envisaged. ESRO

N74-11663# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
ORBIT DETERMINATION OF ARTIFICIAL SATELLITES BY SOLVING A BOUNDARY VALUE PROBLEM USING ANGULAR AND DISTANCE MEASUREMENTS [BAHNBESTIMMUNG AUS RICHTUNGS- UND ENTFERNUNGSMESSUNGEN KUENSTLICHER ERDSATELLITEN ALS RANDWERTAUFGABE]
Karl Heinz Ilk Bonn Bundesmin. fuer Forsch. und Technol. 9 Jun. 1973 64 p refs In GERMAN; ENGLISH summary
(Contracts WRK-132; SFB-78)
(BMFT-FBW-73-12; MITT-102) Avail: NTIS HC $5.25; ZLDI, Munich 13,05 DM

The orbit determination problem is formulated as a least squares adjustment of nonlinear condition equations with unknowns. To solve the problem a method of successive approximation was used. The method described was tested on 60 short arcs of GEOS 1 observed in the first half of 1966. Author (ESRO)

N74-11664# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
SOLUTION OF BOUNDARY VALUE PROBLEMS IN ORBITAL THEORY USING SERIES EXPANSIONS INTO ORTHONORMAL EIGENFUNCTIONS [UEBER DIE VERWENDUNG VON ENTWICKLUNGEN NACH ORTHONORMIERTEN EIGENFUNKTIONEN BEI DER BEHANDLUNG VON RANDWERTAUFGABEN DER PUNKTMECHANIK]
Manfred Schneider Bundesmin. Fuer Forsch. und Technol. Aug. 1973 68 p refs In GERMAN; ENGLISH summary
(Contracts WRK-187; SFB-78)
(BMFT-FBW-73-16) Avail: NTIS HC $5.50; ZLDI, Munich 14,30 DM

The solution of boundary value problems in orbital mechanics is discussed. The application of the Hammerstein method of infinitely many variables to the solution of integral equations leads to an infinite system of conditional equations. Another solution is to make use of the expansions of the complete system of orthonomal eigen functions of the core of the integral equation, resulting in elementary quadratures. This method is applied to two problems in celestial mechanics: treatment of a 1st boundary value problem to differential equations, and orbit determination as a boundary value problem, both associated with perturbation equations. Author (ESRO)

N74-11665# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A REVIEW OF ASTRONOMICAL SEEING
Nicholas J. Krikelis 21 Aug. 1973 40 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-766545; TN-1973-41; ESD-TR-73-238) Avail: NTIS CSCL 04/1

Seeing is the quality or lack of confusion of an optical image, insofar as this is determined by the earth's atmosphere. By seeing phenomena, it is meant just those effects on images that are generally ascribed to atmospheric turbulence: brightness and color scintillation, wandering, dancing, focus drift, pulsation, and the tremor disc. The report discusses this phenomena. GRA

N74-11666# Naval Avionics Facility, Indianapolis, Ind.
THE DETERMINATION OF A NORTH-SOUTH LINE FROM OBSERVATIONS OF POLARIS (NORTH STAR)
Matt M. Matlik Mar. 1973 43 p refs
(AD-766093; NAFI-TR-1906) Avail: NTIS CSCL 08/5

The report provides the theoretical development for assigning the bearing of a reference line to true north using direct observations of Polaris. The solution of the astronomical triangle for the azimuth of Polaris is given. Computation is accomplished through one of two computer programs, and an error analysis is made. Author (GRA)

N74-11084 Joint Publications Research Service, Arlington, Va.
STUDY OF LOCAL TERRAIN ALONG THE LUNOKHOD-1 TRAJECTORY
B. N. Rodionov, B. V. Nepoklonov, and V. V. Kiselev *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 97-112 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

N74-11085 Joint Publications Research Service, Arlington, Va.
DETERMINING GEOMETRIC DIMENSIONS AND DISTRIBUTION OF CRATERS TRAVERSED BY LUNOKHOD-1 ON LUNAR SURFACE
B. I. Garin, A. K. Leonovich, F. P. Pavlov, V. B. Georgiyev, and P. S. Semenov *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 113-119 Transl. into ENGLISH

from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

N74-11086 Joint Publications Research Service, Arlington, Va.
STUDIES OF LUNAR GROUND MECHANICAL PROPERTIES WITH THE SELF-PROPELLED LUNOKHOD-1
A. K. Leonovich, V. V. Gromov, A. V. Rybakov, V. K. Petrov, P. S. Pavlov, I. I. Cherkasov, and V. V. Shvarev *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 120-135 Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

N74-11088 Joint Publications Research Service, Arlington, Va.
PRELIMINARY RESULTS OF GEOMORPHOLOGICAL STUDY OF PANORAMAS
K. P. Florenskiy, A. T. Bazilevskiy, A. A. Pronin, and Z. V. Popova *In its* Lunokhod-1: Mobile Lunar Lab. (JPRS-54525) 22 Nov. 1971 p 147-174 refs Transl. into ENGLISH from the book "Peredvizhnaya Lab. na Lune Lunokhod-1" Moscow, Nauka Publishers, 1971 (For availability see N74-11078 02-11)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N74-11667*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE 8TH AEROSPACE MECHANISMS SYMPOSIUM
Washington Oct. 1973 357 p refs Symp. held at Hampton, Va., 18-19 Oct. 1973
(NASA-TM-X-2934; L-9262) Avail: NTIS HC $7.75 CSCL 22B

The design and development of various mechanisms for space and aeronautical research programs are reported. Emphasis is placed on aerospace mechanisms that have been either flight qualified or flight demonstrated. For individual titles, see N74-11668 through N74-11696.

N74-11668* General Electric Co., Philadelphia, Pa. Space Div.
OSO-7 SPECTROHELIOGRAPH MECHANISMS c14
Donald N. Matteo *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 1-13 (For availability see N74-11667 02-31)
CSCL 22B

The OSO-7 Orbiting Solar Observatory was launched on September 29, 1971. One of the two main sun pointing instruments aboard was a spectroheliograph for monitoring extreme ultraviolet and X-ray radiation from the sun. The instrument has been operating successfully in orbit for approximately two years. The design solution to each of the mechanism tasks is described. Also described are certain developmental problems and their solutions which led to the ultimate mission success. Author

N74-11669* European Space Technology Center, Noordwijk (Netherlands).
DEVELOPMENT OF AND DYNAMIC STUDIES CONCERNING A CABLE BOOM SYSTEM PROTOTYPE c15
G. Bring, G. Schmidt (Dornier-Werke G.m.b.H.), and D. Wyn-Roberts (British Aircraft Corp., Bristol) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 15-23 (For availability see N74-11667 02-31)
CSCL 22B

The conception of a cable boom system for a scientific spin stabilized satellite led to a flat cable stowed on a drum with a flexlead without conversion to avoid slip rings and to facilitate automatic restowage from any state of deployment. Some dynamic features of the extended cable boom and especially the comparison between round and flat cables were investigated in a phenomenological study using a test rig capable of inducing lateral, torsional and thermal cycling disturbances separately or in any combination. Author

N74-11670* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LASER INITIATED EXPLOSIVE DEVICE SYSTEM c33
L. C. Yang, V. J. Menichelli, and J. E. Earnest *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 25-35 refs (For availability see N74-11667 02-31)
(Contract NAS7-100)
CSCL 22B

A laser initiated explosive system has been developed which can simultaneously initiate multiple explosive devices. Advantages of this system over electrically initiated devices (EED's) are increased safety and reliability, simplicity of laser initiated devices, and increased weight efficiency. The system design with test data are presented and a comparison between laser initiation and electrical initiation is discussed. Author

N74-11671* Stanford Univ., Calif.
PRINCIPAL AXES AND MOMENTS OF INERTIA OF DEFORMABLE SYSTEMS c32
T. R. Kane *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 37-48 (For availability see N74-11667 02-31)
CSCL 22B

Information about principal axes and moments of inertia is presented in terms of formulas involving solely quantities which can be expressed in literal form whenever central principal axes can be located by inspection for at least one state of a deformable system composed of particles and rigid bodies. Two illustrative examples are worked out in detail. Author

N74-11672* European Space Research and Technology Center, Noordwijk (Netherlands).
CURRENT EUROPEAN DEVELOPMENTS IN SOLAR PADDLE DRIVES c15
R. H. Bentall *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 49-58 refs (For availability see N74-11667 02-31)
CSCL 22B

The European Space Research and Technology Centre (ESTEC) is sponsoring the development of a number of critical spacecraft hardware items. The hardware under development includes two competing solar paddle drives which are being produced to similar specifications. Three mechanisms of each type are being produced and will undergo thermal vacuum testing. All mechanisms have lead lubricated bearings. Author

N74-11673* Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
TELESCOPIC BOOMS FOR THE HAWKEYE SPACECRAFT c15
Roger D. Anderson *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 59-68 ref (For availability see N74-11667 02-31)
CSCL 22B

Several boom arrangements were proposed for the Hawkeye spacecraft. The design chosen to fly consists of one pair of stem roll-out booms and a set of telescopic booms. Some of the advantages of choosing this boom configuration were that the booms could be stored in the belt line area, which is near the center of gravity of the spacecraft, and also with the approach the telescopic booms could be extended at the spacecraft's initial spin rate (180 rpm). By being able to extend these booms at the initial spin rate of the spacecraft the need for a despin system was eliminated, thus weight saving to the spacecraft. With the method of storage and extension employed by the telescopic design, the desirable sensor distance from the spacecraft could also be attained. Author

N74-11674* General Electric Co., Philadelphia, Pa.
THE DEVELOPMENT AND TEST OF A LONG-LIFE, HIGH RELIABILITY SOLAR ARRAY DRIVE ACTUATOR c15
Don. L. Kirkpatrick *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 69-83 (For availability see N74-11667 02-31)

CSCL 22B

To meet the life and reliability requirements of five to ten year space missions, a new solar array drive mechanism for 3-axis stabilized vehicles has been developed and is undergoing life testing. The drive employs a redundant lubrication system to increase its reliability. An overrunning clutch mechanism is used to permit block redundant application of two or more drives to a common array drive shaft. Two prototype actuator and clutch assemblies, in continuous vacuum life test under load at 10 to the minus 8th power torr for more than sixteen months, have each accumulated more than 34,000 output revolutions without anomaly, the equivalent of more than seven years of operation in a 1000 km orbit or nearly ninety-five years at synchronous altitude. Author

N74-11675* Reusser (Peter) A.G., Zurich (Switzerland).
HIGH PERFORMING ACTUATION SYSTEM FOR USE WITH A LOUVER ARRAY FOR SATELLITE THERMAL CONTROL c15
Peter U. Reusser and Jan A. F. Coebergh *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 85-96 refs (For availability see N74-11667 02-31)
CSCL 22B

A high performing actuation system has been developed to drive one pair or a set of 9 pairs of louver blades. The system uses a Bourdon spiral as the driving member. The response time of the liquid expansion of the spiral system is in the order of three seconds. Besides performance tests, qualification tests have been carried out on a prototype system, demonstrating that the actuation system withstands normal launching conditions; projected operating life of 7 years with more than 7000 cycles can be expected. Author

N74-11676* Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF THE ELEVATION DRIVE ASSEMBLY FOR ORBITING SOLAR OBSERVATORY I (EYE) c15
W. F. Sharpe, M. C. Olson, and B. W. Ward (NASA. Goddard Space Flight Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 97-108 (For availability see N74-11667 02-31)
CSCL 22B

The requirements for pointing accuracy, friction, and power for the elevation drive assembly of an orbiting space observatory are discussed briefly. A description of the components making up the assembly is presented. Special features requiring development testing prior to unit fabrication are more fully described together with a review of the test programs conducted and results obtained. Author

N74-11677* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW APPROACH TO LONG-LIFE NONCONTACTING ELECTROMECHANICAL DEVICES c15
Edward J. Devine *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 109-116 (For availability see N74-11667 02-31)
CSCL 22B

Brushless dc motors are finding increasing application in space. Likewise, with the advent of the light emitting diode, noncontacting encoders are gradually replacing sliding contact types. The direct drive concept has proved its merit and is now the preferred approach for tape recorders and low to moderate torque instrument drives. The final step in this evolution is the magnetic bearing, which now appears feasible for several applications. Where it can be applied in a totally noncontacting system, life and reliability will be a function of the electronic controls, where redundancy, derating, and quality assurance approaches virtually assure the desired lifetime and failure rate. Author

N74-11678* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF THE TECHNOLOGY OF NONCONTACTING SYSTEMS c15
Philip A. Studer *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 117-130 refs (For availability see N74-11667 02-31)
CSCL 22B

Advanced components are the fundamental building blocks of advanced systems and spacecraft. Non-contacting elements, including magnetic bearings, brushless and ironless armature motors, rotary transformers and encoders, are discussed. Most of the information presented in this paper has been generated from a continuing program of component development. The aim of this paper is to identify some of the important design features and provide a perspective on the state of development reached to date. Author

N74-11679* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND DEVELOPMENT OF A MOMENTUM WHEEL WITH MAGNETIC BEARINGS c15
Leo J. Veillette *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 131-143 (For availability see N74-11667 02-31)
CSCL 22B

An engineering model momentum wheel with radial magnetic bearings has been designed and developed and successfully operated to a speed of approximately 500 rad/sec. This speed corresponds to a maximum angular momentum of 83 Nm-sec which is 83% of the design value. The maximum momentum achieved was limited by the suspension servo bandwidth and this, in turn, was limited by the lowest structural resonance of the rotor. Author

N74-11680* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODEL STUDIES OF CROSSWIND LANDING-GEAR CONFIGURATIONS FOR STOL AIRCRAFT c02
Sandy M. Stubbs and Thomas A. Byrdsong *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 145-154 (For availability see N74-11667 02-31)
CSCL 22B

A dynamic model was used to directly compare four different crosswind landing gear mechanisms. The model was landed as a free body onto a laterally sloping runway used to simulate a crosswind side force. A radio control system was used for steering to oppose the side force as the model rolled to a stop. The configuration in which the landing gears are alined by the pilot and locked in the direction of motion prior to touchdown gave the smoothest runout behavior with the vehicle maintaining its crab angle throughout the landing roll. Nose wheel steering was confirmed to be better than steering with nose and main gears differentially or together. Testing is continuing to obtain quantitative data to establish an experimental data base for validation of an analytical program that will be capable of predicting full scale results. Author

N74-11681* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODEL SUPPORT ROLL BALANCE AND ROLL COUPLING c11
Roy E. Sharpes and William J. Carroll *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 155-163 (For availability see N74-11667 02-31)
CSCL 22B

The design concepts of two specialized wind tunnel model support mechanisms are described. The forced oscillation roll balance mechanism was designed to meet the specific requirement to measure aerodynamic forces and moments to permit determination of the damping-in-roll parameters of winged configurations. A variable speed motor is used to oscillate the model by means of an offset crank. The oscillating motion is resisted by a torsion spring to provide a restoring torque and is attached to the section forward of the strain-gage balance. This spring action allows the model to be oscillated at a frequency for velocity resonance, whereby the mechanical spring and any aerodynamic spring balance. This spring action allows the model to be oscillated at a frequency for velocity resonance, whereby the mechanical spring and any aerodynamic spring balance out the model inertia. The only torque then required to oscillate the model at that particular frequency is equal to that due to aerodynamic damping. The second mechanism, a roll coupling for remotely rotating a model, was designed to invert or roll a model about its longitudinal axis when mounted for testing. Author

N74-11682* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SPACECRAFT SEPARATION SYSTEMS MECHANISMS: CHARACTERISTICS/PERFORMANCE DURING HIGH ALTITUDE FLIGHT TEST FROM NASA WALLOPS STATION, VA.

Joseph D. Pride *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 165-178 (For availability see N74-11667 02-31)
CSCL 22B

The applications of various separation mechanisms to meet flight mission goals within the physical and environmental constraints of a single stage rocket test vehicle are considered. Each separation concept was selected from the numerous choices available on the basis of its unique requirement and the flight test vehicle incorporated several different concepts. Attention to specific requirements and thoroughness in design and testing were essential to success since there is no specific single answer to separation problems. Author

N74-11683* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DEVELOPMENT OF LOW-SHOCK PYROTECHNIC SEPARATION NUTS c33

Laurence J. Bement and Vernon H. Neubert (Pennsylvania State Univ.) *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 179-212 (For availability see N74-11667 02-31)
CSCL 22B

Performance demonstrations and comparisons were made on six flight type pyrotechnic separation nut designs, two of which are standard designs in current use, and four of which were designed to produce low shock on actuation. Although the shock performances of the four low shock designs are considerably lower than the standard designs, some penalties may be incurred in increased volume, weight, or complexity. These nuts, and how they are installed, can significantly influence the pyrotechnic shock created in spacecraft structures. A high response monitoring system has been developed and demonstrated to provide accurate performance comparisons for pyrotechnic separation nuts. Author

N74-11684* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ROCKET ENGINE BIPROPELLANT VALVE PROBLEMS AND CURRENT EFFORTS c15

Joseph Fries *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 213-228 (For availability see N74-11667 02-31)
CSCL 22B

In developing the highly successful bipropellant valves for the Apollo primary propulsion engines, a variety of developmental problems were encountered and resolved. These problems and the new technology that is being pursued to eliminate or minimize these problems on the space shuttle orbital maneuvering engine are discussed. The space shuttle, being a reusable system, has new requirements of the valve. The potential effects of these requirements on valve design and potential solutions are also discussed. Author

N74-11685* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METEOROID-DETECTOR DEPLOYMENT AND PRESSURIZATION SYSTEMS c14

H. C. Halliday *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 229-235 (For availability see N74-11667 02-31)
CSCL 22B

The Explorer 46 Meteoroid Technology Satellite (MTS) launched from Wallops Island, Va., August 13, 1972, was configured to fit within the Scout heat shield, 86.36 cm in diameter. In order to package within this envelope, the meteoroid bumper detector panels had to be rolled up unpressurized and secured to the spacecraft main structure. After the spacecraft was placed in orbit the panels were unrolled by a deployment system and inflated by a pressurization system. Author

N74-11686* McDonnell-Douglas Astronautics Co., St. Louis, Mo.

CONTROL VALVE: HOT GAS FAST RESPONSE c15

J. T. Hollis, A. B. Killebrew, and J. M. Smith *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 237-244 (For availability see N74-11667 02-31)
CSCL 22B

The design of a warm gas control valve is reviewed outlining the problems posed by the requirement for extremely fast response combined with a severe environment and a hot, dirty, and corrosive operating fluid. Author

N74-11687* Martin Marietta Aerospace, Orlando, Fla.

THE VIKING SURFACE SAMPLER c14

Robert B. Seger and Vernon P. Gillespie (NASA. Langley Res. Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 245-255 (For availability see N74-11667 02-31)
CSCL 22B

A surface sampler subsystem for the Viking Lander has been designed, fabricated, cleaned, and successfully tested. Testing has included component level tests to qualification environment and subsystem level tests. This development hardware has also been integrated into a System Test Bed (STB) for the lander system. In addition to the normal dynamic and thermal environments the surface sampler hardware has been tested in an aircraft to simulate the effects of the reduced Martian gravity. Although problems have been encountered with the first-build and integration, the basic design appears to be sound and hardware qualification is scheduled for late 1973. Author

N74-11688* Martin Marietta Aerospace, Orlando, Fla.

VIKING LANDER ANTENNA DEPLOYMENT MECHANISM c15

Kenneth H. Hopper and Dean S. Monitor *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 257-269 (For availability see N74-11667 02-31)
CSCL 22B

One of the mechanisms that is included in the configuration of the Viking Mars Lander is an antenna dish deployment mechanism which utilizes a mechanical escapement device for controlling deployment. The criteria require that the mechanism be capable of deploying the antenna under a wide range of aiding and retarding winds after landing on Mars but must limit the acceleration during deployment and latching of the antenna. Adding to the complexity of the design are the requirements for very accurate alignment after erection and heat sterilization prior to launch. This mechanism has been designed, fabricated and successfully tested to qualification test levels for usage on the Viking mission. Author

N74-11689* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.

OPTICAL MODULE FOR THE INTEGRATED REAL-TIME CONTAMINATION MONITOR

E. H. Wrench *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 271-281 refs (For availability see N74-11667 02-31)
CSCL 20F

The concept of a real time contamination monitor is studied and the evolution of the optical module component from laboratory model through the engineering evaluation model is reported. Mechanisms employed and problems experienced are described. Current efforts are directed toward a major simplification of design in a unit intended for flight. Author

N74-11690* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRANSDUCER TECHNOLOGY TRANSFER TO BIOENGINEERING APPLICATIONS c05

E. N. Duran, G. W. Lewis, C. Feldstein, E. Corday (Cedars-Sinai Med. Center), S. Meerbaum (Cedars-Sinai Med. Center), and Tzu-Wang Lang (Cedars-Sinai Med. Center) *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 283-292 refs (For availability see N74-11667 02-31)
(Contracts NAS7-100; HE-14943-01; HL-14644-02)
CSCL 06B

The results of a technology transfer of a miniature unidirectional stress transducer, developed for experimental stress analysis in the aerospace field, to applications in bioengineering are reported. By modification of the basic design and innovations in attachment techniques, the transducer was successfully used in vivo on the myocardium of large dogs to record the change in contractile force due to coronary occlusion, reperfusion, and intervention. Author

N74-11691* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICOPTER VISUAL AID SYSTEM c02
Ronald L. Baisley *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 293-309 ref (For availability see N74-11667 02-31)
CSCL 01C

The helicopter visual aid system has been built and flight tested in situations representative of actual flight missions. The mechanisms discussed contributed greatly to the successful performance of the system throughout the 160 hours of flight testing. It has demonstrated that the visual aid concept can provide improved daytime visual capability, greatly improved nighttime capability, surveillance from greater distances and/or altitudes, covert operation at night through the use of the IR searchlight, and a photographic recording at the scene being viewed. Author

N74-11692* Gyrotrim Corp., Santa Clara, Calif.
A GRAVITY EXERCISE SYSTEM c05
William E. Brandt and Allen L. Clark *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 311-316 ref (For availability see N74-11667 02-31)
CSCL 06B

An effective method for muscle conditioning during weightlessness flight is derived from isometric exercise. The basic principle of gravity exercise is to periodically displace the human body upon reactionless rollers so that spacial equilibrium can only be maintained by the proper tension and relaxation of the body's muscles. A rotating platform mounted upon two degrees of freedom rollers provides such a condition of gravitational reaction stress throughout each of its 360 deg rotation. G.G.

N74-11693* Hughes Aircraft Co., Culver City, Calif.
POLYURETHANE RETAINERS FOR BALL BEARINGS c15
R. I. Christy *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 317-327 ref (For availability see N74-11667 02-31)
CSCL 13I

Evaluation of a new ball bearing retainer material is reported. A special composite polyurethane foam ball retainer has been developed that has virtually zero wear, is chemically inert to hydrocarbon lubricants, and stores up to 60 times as much lubricant per unit volume as the most commonly used retainer material, cotton phenolic. This new retainer concept shows promise of years of ball bearing operation without reoiling, based on life testing in high vacuum. Author

N74-11694* Spar Aerospace Products, Ltd., Toronto (Ontario).
MULTI-POINT RELEASE MECHANISM c15
E. Groskopfs *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 329-334 (For availability see N74-11667 02-31)
CSCL 13I

A multi-point release mechanism used on the communications technology satellite. The mechanism is designed to jettison one large panel and to release a second panel; both panels have independent multi-point attachments to the spacecraft and require to be released in sequence. The solar array is stowed concertina fashion under 2 psi pressure to ensure that no movement occurs between the stowed folds of the array during the launch. One pair of linear pyrotechnic-actuators releases both the JBSA and the pressure plate via the release mechanism. This release mechanism has successfully passed qualification level vibration launch and thermal environment tests and has accumulated to date close to 30 successful releases. Author

N74-11695* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING ORBITER 1975 ARTICULATION CONTROL ACTUATORS c15
G. S. Perkins *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 335-350 (For availability see N74-11667 02-31)
(Contract NAS7-100)
CSCL 22B

The articulation subsystem actuators were rigorously tested in severe environments. They were operated through temperature ranges from -73 C to +121 C. In each case the temperature rate of change was at maximum. The actuator under test at room temperature was put into a pre-chilled or preheated chamber. Satisfactory performance was obtained throughout this full temperature range and under the temperature shock conditions above. However, at temperatures below -78 C some leakage was experienced through the O-ring seal around the shaft. The actuators were subjected to severe vibration and 500 g shock test with a time duration of 0.0007 seconds. The scan actuator was life tested by operating it from stop to stop through 2,000 cycles with 20,000 start-stop procedures randomly distributed through the 2,000 cycles. Author

N74-11696* Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE REQUIREMENT FOR DESIGNING ANALYZABLE SPACE DEPLOYABLE STRUCTURES
Arthur A. Woods, Jr. *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 351-362 (For availability see N74-11667 02-31)
CSCL 22B

The applied technology satellite parabolic reflector subsystem is one of the first systems designed for space environment with limited terrestrial environmental ability. As a result, the complete performance of the system could not be demonstrated in a terrestrial environment without unacceptable design compromises. This problem was circumvented by developing a test philosophy which relied heavily on analysis to qualify and accept the flight hardware. The test program was successfully concluded and an optimized, low cost structure resulted. It is felt that this test and analysis philosophy can be applied to future space systems, resulting in substantial cost and schedule savings and a mission optimized system. Author

N74-11697*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SORTIE LABORATORY, PHASE B TECHNICAL SUMMARY
16 Nov. 1973 200 p
(NASA-TM-X-69442; M-S/E-73-2) Avail: NTIS HC $12.00 CSCL 22B

The design and operational requirements which evolved from Sortie Lab (SL) analysis are summarized. A source of requirements for systems is given along with experimental support for the SL baseline. Basic design data covered include: configuration definition, mission analysis, experimental integration, safety, and logistics. A technical summary outlines characteristics which reflect the influence of the growth in SL capability and the results of the mission and operational analysis. Each of the selected areas is described in terms of objectives, equipment, operational concept, and support requirements. Author

N74-11698*# Scripta Publishing Corp., Washington, D.C.
APPLICATIONS SATELLITES LEGAL ASPECTS. PART 1: SPACE LAW APPLICATIONS SATELLITES
C. A. Colliard NASA Nov. 1973 14 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), v. 12, no. 2, Mar.-Apr. 1973 p 1-5
(Contract NASw-2484)
(NASA-TT-F-15160) Avail: NTIS HC $3.00 CSCL 22C

Since 1958 the U.N. has studied the question of the utilization of extra-atmospheric space for peaceful perposes. The work already accomplished by the U.N. in matters of space law is considerable, including the U.S.-Soviet agreement on cooperation in the field of exploration and utilization of cosmic space, signed in Moscow on May 24, 1972. Within the framework of multilateral agreements the work of ESRO and ELDO is discussed. It is pointed out that applications satellites are intended to be used to realize strictly terrestrial ends, to increase human knowledge and sometimes, as a consequence, human power in the terrestrial domain. Author

N74-11699*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: EARTH LANDING SYSTEM
Robert B. West Washington Nov. 1973 82 p
(NASA-TN-D-7437; JSC-S-370) Avail: NTIS HC $3.75 CSCL 22B

A brief discussion of the development of the Apollo earth landing system and a functional description of the system are presented in this report. The more significant problems that were encountered during the program, the solutions, and, in general, the knowledge that was gained are discussed in detail. Two appendixes presenting a detailed description of the various system components and a summary of the development and the qualification test programs are included. Author

N74-11700# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
TECHNOLOGICAL AND COMMERCIAL DEVELOPMENT TRENDS IN COMMUNICATON SATELLITES [TECHNOLOGISCHE UND KOMMERZIELLE ENTWICKLUNGSTRENDS BEI NACHRICHTENSATELLITEN]
P. Hartl (DFVLR, Oberpfaffenhofen, West Ger.) and D. E. Koelle 1973 8 p In GERMAN Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973
(DGLR-Paper-73-039) Avail: NTIS HC $3.00

A review of the application and the technological and commercial development of communication satellites is presented. The applications include: intercontinental communication (intelsat network), regional communication, tactical and strategical services, aeronautical and maritime traffic control, and direct TV broadcasting. Some trends in technological development are indicated, such as global satellites, three-axis stabilization, frequency bands, and power supply. A prognosis for the commercial development of intercontinental and regional communication is given. ESRO

N74-11701# Siemens A.G., Munich (West Germany).
CONCEPT STUDY OF A TELEVISION BROADCASTING SATELLITE, PREPHASE A. VOLUME 1: SUMMARY Final Report [KONZEPTSTUDIE FUER EINEN FERNSEHRUNDFUNKSATELLITEN, VORPHASE A. SCHLUSSBERICHT BAND 1: ZUSAMMENFASSUNG]
May 1972 29 p In GERMAN Prepared jointly with Standard Elektrik Lorenz and Messerschmitt-Boelkow-Blohm
(Contract RV-2/1-v-1/71-QH-00-10)
Avail: NTIS HC $3.50

A feasibility study for a television broadcasting satellite is summarized. Four concepts were developed as a result of different requirements for private television sets, and are thus based on different modulation and communication methods. The following items are discussed: communication system, transmitter power and power supply, and satellite antenna attitude control. The proposed schedule and a cost estimate are given for the full project. ESRO

N74-11702# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JUNE 1973
R. D. Eberst 18 Jul. 1973 19 p
(ROE-STS-155) Avail: NTIS HC $3.00

Stopwatch observations made at stations connected with the Section during June 1973 are listed in satellite launch and time order: 294 fully reduced observations of 69 satellites. Author (ESRO)

N74-11703# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
HEWITT CAMERA OBSERVATIONS MADE AT EARLYPOINT ON VARIOUS SATELLITES FROM 1 SEPTEMBER TO 31 DECEMBER 1970
K. S. Russell 9 Aug. 1973 35 p ref
(ROE-STS-156) Avail: NTIS HC $3.75

Satellite observations made with a Hewitt camera at Earlyburn Outstation are given. Author (ESRO)

N74-11704# Royal Observatory, Edinburgh (Scotland).
HEWITT CAMERA OBSERVATIONS MADE A EARLYPOINT ON VARIOUS SATELLITES FROM 1 JANUARY TO 30 APRIL 1971
K. S. Russell 10 Aug. 1973 27 p ref
(ROE-STS-157) Avail: NTIS HC $3.50

Satellite observations made with a Hewitt camera at Earlyburn outstation are listed in satellite launch and time order for the period from 1 January to 30 April 1971: fully reduced observations of 22 Transits of 10 satellites. Author (ESRO)

N74-11705# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JULY 1973
R. D. Eberst 22 Aug. 1973 24 p
(ROE-STS-158) Avail: NTIS HC $3.25

Stopwatch observations made at stations connected with the section during July 1973 are listed in satellite launch and time order: 359 fully reduced observations of 102 satellites. Author (ESRO)

N74-11706# Space Data Corp., Phoenix, Ariz.
DESIGN, DEVELOPMENT AND FLIGHT TEST OF THE SUPER LOKI STABLE BOOSTER ROCKET SYSTEMS Final Report, 3 Jan. - 30 Jun. 1973
Bruce Bollermann and Robert L. Walker 30 Jun. 1973 126 p ref
(Contract F19628-72-C-0195; AF Proj. 6670)
(AD-766737; AFCRL-TR-73-0412) Avail: NTIS CSCL 22/2

The Super Loki stable booster rocket systems have been developed to obtain high altitude temperature, density, and wind measurements by means of small inexpensive rocket systems which have post-burnout stable booster trajectories. These systems can be used at ranges where booster wind drift is a safety problem. The expended rocket booster impacts at a range of about 15,000 feet or 2.46 nautical miles from the launch site. These systems have been developed to replace the Super Loki PWN-10A, PWN-10B, and PWN-12A at launch sites requiring either transponder or falling sphere payloads and stable booster impacts. Author (GRA)

N74-11707# Calspan Corp., Buffalo, N.Y. Aerosciences Div.
TRANSONIC WIND TUNNEL TESTS ON A MISSILE MODEL WITH CANARD WINGS, VOLUME 2
R. E. Kuyper Jul. 1973 676 p
(Contract DAAH03-73-C-0243)
(AD-766660; CALSPAN-AA-4017-W-9-Vol-2) Avail: NTIS CSCL 16/4

The report is Volume 2 of a three volume series. Tables of aerodynamic test data are given, including balance cavity and base pressure coefficients, axial force for aerodynamic and thrust phases, canard position, and force and moment coefficients for a series of runs. GRA

N74-11708# Calspan Corp., Buffalo, N.Y. Aerosciences Div.
TRANSONIC WIND TUNNEL TESTS ON A MISSILE MODEL WITH CANARD WINGS, VOLUME 3
R. E. DeKuyper Jul. 1973 667 p
(Contract DAAH03-73-C-0243)
(AD-766661; CALSPAN-AA-4017-W-9-Vol-3) Avail: NTIS CSCL 16/4

Volume 3 of a three volume report tabulates aerodynamic and thrust test data on a wind tunnel model of a guided missile with canard wings. Included are tail fin force and moment coefficients. GRA

N74-11709# Xerox Electro-Optical Systems, Pasadena, Calif.
ANNULAR COLLOID THRUSTER FOR THREE-AXIS STABILIZED MILITARY SATELLITES Final Report, Nov. 1971 - Jun. 1973
Julius Perel, John F. Mahoney, and Howard L. Daley Jul. 1973 136 p refs
(Contract F04611-72-C-0019)
(AD-766405; EOS-4081-F; AFRPL-TR-73-38) Avail: NTIS CSCL 22/2

Research and development was performed on colloid annular emitter technology which culminated in the fabrication and testing of two multiemitter array configurations. Initial work was devoted to upgrading the time-of-flight (TOF) instrumentation system with subsequent improvement in the quality of TOF data. Propellant mass flowmeter techniques were improved enabling meaningful studies to be conducted correlating TOF with direct mass flow measurements. Thruster performance was improved through an emphasis on increasing distribution efficiencies and

by optimizing geometry and propellant. (Modified author abstract) GRA

N74-11710# Naval Ordnance Station, Louisville, Ky.
METALLURGICAL REPORT OF HYDROSTATICALLY EXTRUDED HALF-SCALE ASROC MOTORCASES Final Report
Sep. 1972 28 p refs
(AD-766795; NOSL-MT-015) Avail: NTIS CSCL 19/7

The report contains the results from the evaluation of the hydrostatic extrusion process performed on half-scale ASROC Motorcases, A1 S1 1010 steel tubing. Dimensional inspection revealed the inability to maintain circulatory straightness, and an acceptable surface finish. Apparent lubricant failure during the extruding process resulted in stretch marks or actual surface tears which proved to be detrimental to the materials: mechanical properties. (Modified author abstract) GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-11711 Oregon State Univ., Corvallis.
TRANSPIRATION COOLING OF A ROTATING DISK Ph.D. Thesis
William Primm Cosart 1973 125 p
Avail: Univ. Microfilms Order No. 73-12859

Heat transfer coefficients were experimentally determined for a transpiration-cooled rotating disk. Comparison of the experimental results to a theoretical prediction by Sparrow and Gregg is made. Air was injected into an air environment. The heat transfer surface used was a four-inch disk constructed of fine mesh, porous stainless steel. Temperature of the rotating surface was measured with an infrared radiometer, accurate to one-half to two degrees Fahrenheit, depending on the temperature. The radiometer was calibrated each day by focusing on a stationary surface of material identical to the rotating disk. Temperature of the stationary calibrator surface was measured with calibrated thermocouples. The effect of both injection rate and rotational rate was investigated. Within the range of variables studied, it was found that transpiration decreased the heat transfer coefficient from a rotating disk by as much as 80% compared to the value expected for a nonporous disk. Dissert. Abstr.

N74-11712 Stanford Univ., Calif.
CREEP BUCKLING OF PLATES AND SHELLS Ph. D. Thesis
Jean-Michel Pierre Benoit 1973 317 p
Avail: Univ. Microfilms Order No. 73-14861

The present investigation consists of three main parts. The first part - creep buckling of flat plates - is an experimental investigation of the effect of creep on the load carrying capacity of flat plates. The second part - creep buckling of circular cylindrical shells - describes an experimental analysis of the influence of creep on the buckling stability of electroplated nickel cylinders. The third part - interaction between axisymmetric and multilobed creep buckling of circular cylindrical shells - investigates the effect of very small multilobed initial radial deformations upon the deformation pattern and the critical buckling time of thin-walled circular cylindrical shells manufactured with initial axisymmetric deformations. Dissert. Abstr.

N74-11713 Georgia Inst. of Tech., Atlanta.
STATIC AND DYNAMIC BEHAVIOR OF TENSIONED DOUBLY-CONNECTED PLATES Ph.D. Thesis
Guerry Clark Backer 1972 124 p
Avail: Univ. Microfilms Order No. 73-14077

The results of an investigation of the local static stability of an infinite plate containing a circular hole are presented. A Galerkin method for solving the governing differential equations is used and the results are compared with those obtained by a previous investigator. It was found that the local critical tensile load differed by approximately a factor of two. The results of a study of the natural foration of a large circular plate containing a circular hole are also given. Static stability information is obtained from the approximate solution to the vibration problem. For large values of the ratio of the outer boundary radius to the inner boundary radius, the static stability results obtained in the vibration problem are compared with the results obtained in the static stability investigation. The results are in good agreement with each other. Dissert. Abstr.

N74-11714*# Battelle Columbus Labs., Ohio.
ANALYSIS OF FATIGUE, FATIQUE-CRACK PROPAGATION, AND FRACTURE DATA Final Report
Carl E. Jaske, Charles E. Feddersen, Kent B. Davies, and Richard C. Rice Nov. 1973 182 p refs
(Contract NAS1-11344)
(NASA-CR-132332) Avail: NTIS HC $11.25 CSCL 20K

Analytical methods have been developed for consolidation of fatigue, fatigue-crack propagation, and fracture data for use in design of metallic aerospace structural components. To evaluate these methods, a comprehensive file of data on 2024 and 7075 aluminums, Ti-6A1-4V, and 300M and D6Ac steels was established. Data were obtained from both published literature and unpublished reports furnished by aerospace companies. Fatigue and fatigue-crack-propagation analyses were restricted to information obtained from constant-amplitude load or strain cycling of specimens in air at room temperature. Fracture toughness data were from tests of center-cracked tension panels, part-through crack specimens, and compact-tension specimens. Author

N74-11715# Toronto Univ. (Ontario).
PROPAGATION OF SPHERICAL STRESS WAVES IN SOLIDS
J. R. McCullough May 1973 148 p refs Sponsored by Def. Res. Board of Can.
(UTIAS-187) Avail: NTIS HC $9.50

Experimental techniques have been developed to study the passage of spherical elastic and elastic-plastic stress waves in homogeneous media. A capsulated strain gage technique was used to measure static and dynamic elastic strains at interior points in a solid. Experimental results were compared with theoretical predictions and excellent agreement was found. To study the effects of the propagation of a spherical elastic-plastic wave front in an isotropic homogeneous solid, hemispherical specimens of OFHC copper were explosively loaded using PETN charges placed at the center of a hemispherical cavity contained within the specimen. The agreement between the experimental data and the theoretical predictions was good. For engineering design purposes it has thus been demonstrated that the use of a standard static yield criterion and an experimentally derived simple constitutive relationship allowed an accurate prediction to be made of the plastic deformation within a solid subjected to impulsive loading. Author

N74-11716# Ghent Univ. (Belgium). Lab. for Strength of Materials and Welding Technology.
CREEP RUPTURE TESTS ON CYLINDER TO CYLINDER INTERSECTIONS Progress Report
Wilfried Sys Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Mar. 1973 22 p refs Sponsored by the Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr. (IRSIA)
(CRIF-MT-81) Avail: NTIS HC $3.25

A program consisting of creep rupture tests on cylinder to cylinder intersections with the aim of comparing the behavior with that of unpierced cylinders is described. The material used (chromium-molybdenum steel) and the test specimens are described. The influence of welding and post weld heat treatment is recognized but not specially considered. Relatively long term creep tests are to be carried out and the results of tests so far are discussed. ESRO

N74-11717 Ghent Univ. (Belgium). Lab. for Material Resistance and Welding Technology.
THIN WALL TORISPHERICAL PRESSURE VESSEL HEADS WITH SMALL TORUS RADIUS. PART 1: STRESS MEASUREMENT RESULTS. PART 2: CALCULATIONS [FONDS TORISPHERIQUES A PAROI MINCE ET PETI-

TRAYON DE CARRE. 1ERE PARTIE: RESULTATS DES MEASURES DE CONTRAINTES. 2EME PARTIE: CALCUL]
Joris Decock Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Feb. 1973 46 p refs In FRENCH Sponsored by the Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-80) Avail: NTIS HC $4.50

Ohmic extensometer measurements of structural stresses in thin wall torispherical container heads with small torus radius during hydraulic tests are presented. The AE20A (NBN 631) steel container heads had structural ratios of 100 to 200 for the tank diameter to head thickness ratio and less or equal to 0.05 for the torus to tank diameter ratio. Circular and longitudinal stresses were measured. For the latter, maximum values appear on the internal side at the middle of the toric section. The structured ratio being outside the norms specified in ISO 312, BS-1515, and ASME, a comparison of the form factors deduced theoretically (by the Winn method or plastic analysis) or experimentally according to the Tresca or Lame criteria is presented showing the ISO curves and the Winn method in good agreement with experimental results. A method of calculation of such container heads is proposed and relevant curves given. ESRO

N74-11718# Institut Franco-Allemand de Recherches, St. Louis (France).
STRONG AND WEAK SHOCK WAVES. EXPERIMENTS AND CALCULATIONS [STARKE UND SCHWACHE STOSSWELLEN. EXPERIMENTE UND BERECHNUNGEN]
M. Schaffar 30 Jan. 1973 18 p refs In GERMAN
(ISL-NB-1/73) Avail: NTIS HC $3.00

Experimental results were compiled concerning the behavior of structural steel- and synthetic resin concrete elements exposed to strong and weak shock waves. The test facilities (blast load simulator, shock tube) and methods used are described. The investigations of structural steel concrete elements led to a plate shape, which can withstand the shock waves. The manufacture of shear plates is rather combersome, as a good cohesion between concrete and steel is strictly necessary. A solution was found by using synthetic resin concrete instead, which is lighter and has a more homogeneous structure. The effects of sonic booms on the thin internal walls of a house were also investigated using a sonic boom generator. It is shown that thin internal walls can withstand sonic booms of at least seven to eight times the normal Concorde boom. ESRO

N74-11719# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
A MATHEMATICAL THEORY OF PLASTICITY FOR STRAIN HARDENING MATERIALS EXHIBITING INITIAL ANISOTROPY
A. U. DeKoning 20 Sep. 1972 25 p refs Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-72117-U) Avail: NTIS HC $3.25

A model is presented for anisotropic hardening in continuous plastic deformation of rolled sheet materials used in aircraft structures and exhibiting anisotropy due to initial permanent strains. Isotropic material behavior is assumed for all elastic deformations. The plastic behavior of the material is described by a series model: an infinite number of particles with linear strain hardening behavior is linked in series in such a way that all are submitted to the same stress. Procedures for deriving anisotropy parameters and a strain hardening coefficient are presented. It is concluded that further studies are necessary not only for a deeper insight into the yielding behavior of materials but also for analysis of problems related to residual stresses, plastic energy dissipation and ductile fracture criteria. ESRO

N74-11720# Brown Univ., Providence, R.I. Dept. of Engineering.
PLASTIC WAVES IN A RATE SENSITIVE MATERIALS. PART 1: WAVES OF UNIAXIAL STRESS
J. C. C. Hsu and R. J. Clifton Jul. 1973 43 p refs
(Contract DAHC04-70-C-0035; Grant NSF GK-10584)
(AD-766755; AROD-9288-3-E-Pt-1) Avail: NTIS CSCL 11/6

Experiments have been carried out in which longitudinal plastic waves have been propagated in thin-walled tubes of alpha-titanium. Strain-time profiles recorded in these experiments show evidence of (1) stress levels considerably above quasi-static values at the same strain (2) decay of the amplitude of the elastic precursor, and (3) variation with distance of propagation of the speed at which a given level of strain propagates. These features of the strain-time profiles are interpreted as indicating that a strain rate dependent theory is necessary to describe the observed wave phenomena. Numerical solutions based on such a theory agree reasonably well with experimental results. For these solutions a plastic strain-rate function is used which agrees with data from quasi-static and split Hopkinson bar tests on the same tubes. Author (GRA)

N74-11721# Army Materials and Mechanics Research Center, Watertown, Mass.
LOCALIZATION OF STRAIN IN A DEFORMING SHEET
Morris Azrin and Bud C. Wonsiewicz Apr. 1973 20 p refs
(DA Proj. 1T0-62105-A-328)
(AD-766680; AMMRC-TR-73-20) Avail: NTIS CSCL 11/6

A method for obtaining numerical solutions to the Marciniak-Kuczynski analysis for the localization of strain in a deforming sheet is presented. It is found that deformation can start either as plane-strain flow at a local weakness, or as simultaneous yielding in this region and the remainder of the sheet. A third deformation mode, which is not included in the above analysis, occurs when the imposed stress state is that of plane strain. A discussion and equations describing this behavior are also included. The necessity of considering the metallurgical behavior and its influence on the mechanical properties used in the analysis is discussed. Author (GRA)

N74-11722# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
NONLINEAR CRACK ANALYSIS WITH FINITE ELEMENTS
Harry Armen, Jr., Earnesto Saleme, Alan Pifko, and Howard Levine Jul. 1973 50 p refs
(AD-766558; RE-460J) Avail: NTIS CSCL 11/6

The paper is concerned with the use of finite element methods to provide a reasonably accurate and realistic analytic representation of the nonlinear behavior of arbitrary two dimensional bodies containing cracks. Specific methods are proposed that would provide capabilities necessary to obtain information concerning An accurate description of the maximum, minimum, and residual near-tip stress and strain fields. The effects of crack closure on the near-tip behavior of the stress and strain field during cyclic loading into the plastic range; The stress-strain and displacement field behavior associated with a nonstationary crack; and the effects of large rotation near the crack-tip. (Modified author abstract) GRA

N74-11723# California Univ., Berkeley. Dept. of Materials Science and Engineering.
A SIMPLE METHOD FOR CHARPY IMPACT TESTING BELOW 6 DEG K
S. Jin, W. A. Horwood, J. W. Morris, Jr., and V. F. Zackay Jul. 1973 19 p refs
(Contract N00014-69-A-0200-1062; NR Proj. 031-762)
(AD-766851; MSE-73-1; TR-1) Avail: NTIS CSCL 20/12

The report describes a simple, inexpensive technique for conducting Charpy impact tests at temperatures as low as 5-6K. A Charpy V-notch specimen is wrapped in styrofoam and placed inside a thin-walled lucite box. Liquid helium is then transferred to the box system at 2-3 psi dewar pressure and a flow rate of approximately 2 liters/minute using a vacuum insulated transfer line. A steady state temperature of 5-6K is quickly attained and maintained as long as helium transfer is continued. Tests comparing the proposed technique to the ASTM standard method at liquid nitrogen temperature indicate that a reasonably accurate impact energy is obtained. Author (GRA)

N74-11724# Army Materials and Mechanics Research Center, Watertown, Mass.
INHOMOGENEOUS DEFORMATION AND STRAIN-RATE EFFECTS IN HIGH STRENGTH TRIP STEELS
Morris Azrin, Gregory B. Olson, and Roger A. Gagne Mar. 1973 28 p refs
(DA Proj. 1T0-62105-A-528)
(AD-766237; AMMRC-TR-73-12) Avail: NTIS CSCL 11/6

Tensile true stress-strain curves were obtained on high strength TRIP steel for a range of strain rates and test

temperatures. It was possible to determine the true-stress and -strain, and strain-rate during periods of Luders band formation, uniform elongation, and final necking. In service, where dynamic loading conditions exist, either the formation of a Luders band must be prevented, or the temperature sensitivity of the material must be decreased if the normal ductility of the material is to be realized. Methods for preventing the formation of a Luders band or reducing temperature sensitivity are discussed. (Modified author abstract) GRA

N74-11725# Brown Univ., Providence, R.I. Dept. of Engineering.
PLASTIC WAVES IN A RATE SENSITIVE MATERIAL. PART 2: WAVES OF COMBINED STRESS
J. C. C. Hsu and R. J. Clifton Jul. 1973 27 p refs
(Contract DAHC04-70-C-0035; Grant NSF GK-10584)
(AD-766756; AROD-9288-4-E-Pt-2) Avail: NTIS CSCL 11/6

Experiments are reported in which combined longitudinal and torsional plastic waves are generated in thin-walled tubes of alpha-titanium by subjecting pre-torqued tubes to longitudinal impact. Longitudinal and torsional strain-time profiles are recorded at several stations along the specimen. The experiments show no evidence of an intermediate constant state region; furthermore, a final constant state region is not observed even though the latest times of observation are greater than the time at which, according to a strain rate independent theory, a constant strain-rate region is expected. Straightforward generalization of the rate dependent theory of Part I (AD-766 755) to allow for combined stress states leads to a theory which predicts the observed strain-time profiles with good accuracy. Author (GRA)

N74-11726# Catholic Univ. of America, Washington, D.C. School of Engineering and Architecture.
DISPLACEMENTS AND FINITE-STRAIN FIELDS IN A HOLLOW SPHERE SUBJECTED TO LARGE ELASTIC DEFORMATIONS
T. L. Chen and A. J. Durelli Sep. 1973 34 p refs
(Contract N00014-67-A-0377-0011)
(AD-766814; Rept-32) Avail: NTIS CSCL 20/11

The paper presents the fields of displacements and strains in a hollow sphere diametrically loaded to seven levels of loads. Polyurethane rubber was used to make the hollow sphere and grids and moire gratings were printed on a meridian plane to measure displacements. The maximum applied vertical displacement reduced the outer diameter of the hollow sphere by about 20 percent. It was found that the horizontal displacement of the ends of the horizontal diameter divided by its deformed length is linear up to that load. Strains were obtained by photographic differentiation. Strains obtained for low levels of load were compared at two points of interest to those obtained using a series by Golecki for the inside boundary, and found appreciably lower. Results are presented in terms of dimensionless loads and Eulerian strains. The largest Eulerian strain recorded is about 30%, the smallest is of the order of 0.001. Stress distributions will be given in another paper. Author (GRA)

N74-11671* Stanford Univ., Calif.
PRINCIPAL AXES AND MOMENTS OF INERTIA OF DEFORMABLE SYSTEMS
T. R. Kane *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 37-48 (For availability see N74-11667 02-31)
CSCL 22B

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-11727*# Houston Univ., Tex. Systems Design Inst.
A HYDROGEN ENERGY CARRIER. VOLUME 1: SUMMARY
Robert L. Savage, ed., Lee Blank, ed., Tom Cady, ed., Kenneth Cox, ed., Richard Murray, ed., and Richard Dee Williams, ed. Sep. 1973 27 p
(Grant NGT-44-005-114)
(NASA-CR-135995) Avail: NTIS HC $3.50 CSCL 20M

The production, technology, transportation, and implementation of hydrogen into the energy system are discussed along with the fossil fuel cycle, hydrogen fuel cycle, and the demands for energy. The cost of hydrogen production by coal gasification; electrolysis by nuclear energy, and solar energy are presented. The legal aspects of a hydrogen economy are also discussed. F.O.S.

N74-11728*# Houston Univ., Tex.
A HYDROGEN ENERGY CARRIER. VOLUME 2: SYSTEMS ANALYSIS
Robert L. Savage, ed., Lee Blank, ed., Tom Cady, ed., Kenneth Cox, ed., Richard Murray, ed., and Richard Dee Williams, ed. Sep. 1973 158 p refs
(Grant NGL-44-005-114)
(NASA-CR-136007) Avail: NTIS HC $10.00 CSCL 20M

A systems analysis of hydrogen as an energy carrier in the United States indicated that it is feasible to use hydrogen in all energy use areas, except some types of transportation. These use areas are industrial, residential and commercial, and electric power generation. Saturation concept and conservation concept forecasts of future total energy demands were made. Projected costs of producing hydrogen from coal or from nuclear heat combined with thermochemical decomposition of water are in the range $1.00 to $1.50 per million Btu of hydrogen produced. Other methods are estimated to be more costly. The use of hydrogen as a fuel will require the development of large-scale transmission and storage systems. A pipeline system similar to the existing natural gas pipeline system appears practical, if design factors are included to avoid hydrogen environment embrittlement of pipeline metals. Conclusions from the examination of the safety, legal, environmental, economic, political and societal aspects of hydrogen fuel are that a hydrogen energy carrier system would be compatible with American values and the existing energy system. For individual titles, see N74-11729 through N74-11735.

N74-11729* Houston Univ., Tex.
[SUMMARY OF SYSTEMS ANALYSIS OF HYDROGEN AS AN ENERGY CARRIER IN THE UNITED STATES]
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 1-3
(For availability see N74-11728 02-33)
CSCL 20M

Hydrogen is discussed in terms of meeting the energy demands of the current energy shortage in the U.S. Hydrogen is considered compatible with all fuel needs, except for on-board storage in automotive-type vehicles. Handling and safety factors are considered compatible to other high energy fuel. It is concluded that hydrogen is an environmentally desirable energy source, and is readily acceptable in the American energy system. F.O.S.

N74-11730* Houston Univ., Tex.
[CURRENT ENERGY SHORTAGE IN THE UNITED STATES]
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 5-12 refs (For availability see N74-11728 02-33)
CSCL 20M

An overview is presented of the study to use hydrogen as an energy source for meeting the current energy shortage. The fossil fuel cycle, and the hydrogen fuel cycle are discussed along with energy flow patterns. F.O.S.

N74-11731* Houston Univ., Tex.
PRODUCTION OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 13-59 refs (For availability see N74-11728 02-33)
CSCL 20M

Methods for producing hydrogen for a hydrogen economy are analyzed. Solar, wind, coal, and nuclear energies are considered as primary sources of energy for the electrolysis of water. Coal gasification processes are discussed along with thermochemical water decomposition by closed cycle processes. F.O.S.

N74-11732* Houston Univ., Tex.
TRANSMISSION AND STORAGE OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 61-76 refs (For availability see N74-11728 02-33)
CSCL 20M

Transmission and storage techniques for hydrogen are evaluated. Gaseous hydrogen and natural gas systems are discussed along with liquid hydrogen systems, and solid hydride storage systems are described. It is concluded that hydrogen gas pipeline systems are feasible, but attention must be given to the embrittlement of pipeline metals. F.O.S.

N74-11733* Houston Univ., Tex.
USAGE OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 77-116 refs (For availability see N74-11728 02-33)
CSCL 20M

Emphasis was placed on minimizing the use of fossil fuels, while meeting reasonable energy demands of our society. Due to the many and complex uses of energy, a careful study was made of the several different areas of the entire energy picture. The demand for energy involves a study of the forms of work and a forecast of the quantities required for each form. Also included is a plan to implement the conversion from present fuels to hydrogen, with a careful consideration being given to the impact of the conversion on society and the environment. Author

N74-11734* Houston Univ., Tex.
SAFETY, LEGAL, ENVIRONMENTAL, ECONOMIC, POLITICAL, AND SOCIAL ASPECTS OF HYDROGEN **c34**
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 117-146 refs (For availability see N74-11728 02-33)
CSCL 05C

The impact of the hydrogen energy system on society was studied. Areas discussed include: federal and state responsibilities for safety; appliance safety standards; industrial uses and safety; assessment of the danger in the widespread use of hydrogen; legal aspects of the energy system; and the environmental implications. F.O.S.

N74-11735* Houston Univ., Tex.
IMPLEMENTATION OF A HYDROGEN ENERGY CARRIER SYSTEM **c15**
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 147-151 (For availability see N74-11728 02-33)
CSCL 13H

A program for the implementation, by stages, of a hydrogen energy system is proposed based on established methods of production, distribution, and use. The stages for the production of hydrogen progresses from coal gasification, through nuclear power to a hydrogen society. F.O.S.

N74-11736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIGURE-OF-MERIT CALCULATION METHODS FOR ORGANIC HEAT-PIPE FLUIDS
James F. Morris Washington Nov. 1973 13 p refs
(NASA-TM-X-2945; E-7632) Avail: NTIS HC $2.75 CSCL 20M

With only chemical formulas and operating temperatures specified, selected correlating equations and tables of chemistry-effect functions allow estimates of figures of merit for organic heat-pipe-fluids. Author

N74-11737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF GAGE SIZE ON THE MEASUREMENT OF LOCAL HEAT FLUX
Kenneth J. Baumeister and Stephen S. Papell Washington Nov. 1973 17 p refs
(NASA-TM-X-2943; E-7526) Avail: NTIS HC $2.75 CSCL 20M

General formulas are derived for determining gage averaging errors of strip-type heat flux meters used in the measurement of one-dimensional heat flux distributions. In addition, a correction procedure is presented which allows a better estimate for the true value of the local heat flux. As an example of the technique, the formulas are applied to the cases of heat transfer to air slot jets impinging on flat and concave surfaces. It is shown that for many practical problems, the use of very small heat flux gages is often unnecessary. Author

N74-11738*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF AN AIR-ASSISTED FUEL NOZZLE TO REDUCE IDLE EMISSIONS OF A JT8D ENGINE COMBUSTOR
Leonidas C. Papathakos and Robert E. Jones Washington Nov. 1973 10 p refs
(NASA-TM-X-2946; E-7580) Avail: NTIS HC $2.75 CSCL 20M

Tests were performed at typical engine idle conditions on a single-can JT8D combustor installed in a 24 centimeter (9.45 in.) housing to evaluate the effect of an air-assist nozzle on reducing exhaust emissions. By injecting high-pressure air through the secondary-flow passage of a standard duplex fuel nozzle, it was possible to reduce hydrocarbon emissions from 840 parts per million to 95 parts per million and carbon monoxide emissions from 873 parts per million to 258 parts per million, NOX emissions increased slightly from 18 parts per million to 22 parts per million. An air-assist differential pressure of only 20.1 newtons per square centimeter (29.1 psi) and an airflow rate of only 0.22 percent of the total combustor airflow was required. Author

N74-11739# Brown, Boveri und Cie. A.G., Heidelberg (West Germany). Zentrales Forschungslab.
A NOVEL METHOD OF COOLING SEMICONDUCTOR DEVICES FOR POWER ELECTRONICS [NEUARTIGES KUEHLVERFAHREN FUER BAUELEMENTE DER LEISTUNGSELEKTRONIK]
Hermann Birnbreier, Gregor Gammel, Uwe Heidtmann, Mattias Joens, and Peter Pawlowski Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 114 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-73-02) Avail: NTIS HC $7.75; ZLDI, Munich 23,55 DM

The development of heat pipe coolers for semiconductors in electric power supplies is discussed. The maximum dimensions were calculated for a given heat flux capability. Technologies necessary for the construction of heat pipes were developed, such as the manufacturing of capillary structures as well as the filling and sealing of heat pipes. Various samples of different design were built, and the influence of heat throughput, heat pipe position, and cooling air velocity on the heat resistance and temperature distribution were experimentally determined. The startup behavior of a heat pipe cooler was examined at room temperature and at temperatures below the freezing point of the working fluid. Corrosion tests performed so far have shown that the material combination copper-water is suitable for heat pipe coolers within the desired temperature range and that prospective lifetimes can be reached. ESRO

N74-11740# Institut Franco-Allemand de Recherches, St. Louis (France).
REACTION MODES OCCURRING AT DETONATION OF EXPLOSIVE GAS MIXTURE DUE TO DETACHED SHOCK FRONT FROM A BLUNT MOCKUP AT SUPERSONIC SPEEDS [UEBER DIE REAKTIONSFORMEN BEI DER ZUENDUNG EINES EXPLOSIVEN GASGEMISCHES DURCH DEN ABGELOESTEN STOSS VOR EINEM MIT UEBERSCHALLGESCHWINDIGKEIT FLIEGENDEN, STUMPFEN MODELL]
H. F. Lehr 30 Aug. 1972 34 p refs In GERMAN
(ISL-28/72) Avail: NTIS HC $3.75

The different reaction and flow types associated with the shock induced combustion of a premixed, detonable gas mixture are described. The combustion of the gas mixture is induced by a shock wave formed in front of a hypersonic blunt body. The velocity range examined contains the detonation velocity of the investigated gas mixture. It appears that this value has an important role. A summary is given of all the tests carried out with spherical bodies and with hydrogen/oxygen and hydrogen/air mixtures. The H2/O2 mixture has some peculiarities in its reaction form in the Mach number range between M = 4 and 5 at low

pressure, which are common to the systems H2/O2 and H2/air. ESRO

N74-11741# Georgia Inst. of Tech., Atlanta.
MECHANISMS OF COMBUSTION Final Report
T. L. Boggs, D. E. Zurn, W. C. Strahle, Jr., J. C. Handley, and T. T. Milkie Jul. 1973 129 p refs
(Contract N00123-72-C-0242)
(AD-766467; NWC-TP-5514) Avail: NTIS CSCL 21/8

The report summarizes studies of the combustion of ammonium perchlorate-polymeric binder-ammonium perchlorate sandwiches. The first section describes the combustion of sandwiches utilizing polyurethane, carboxyl-terminated polybutadiene, hyroxyl-terminated polybutadiene, or polybutadiene acrylic acid binders. The second section deals with the deflagration of sandwiches with Fe2O3 or Harshaw CuO2O2 catalysts incorporated in the ammonium perchlorate, the HTPB binder, or at the AP-HTPB interface. The third section is concerned with the combustion of sandwiches incorporating as-received or a special preoxidized aluminum within the HTPB binder. The final section is comprised of an analytical modeling of the sandwich combustion. Author (GRA)

N74-11633* Texas Univ., Austin. Dept. of Astronomy.
THERMODYNAMICS OF HYDROGEN-HELIUM MIXTURES AT HIGH PRESSURE AND FINITE TEMPERATURE
W. B. Hubbard *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 65-68 refs (For availability see N74-11621 02-30)
(Grant NSF GP-19667)
Copyright. CSCL 20M

N74-11646* California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics and Dept. of Planetary and Space Science.
LATTICE MODEL CALCULATION OF ELASTIC AND THERMODYNAMIC PROPERTIES AT HIGH PRESSURE AND TEMPERATURE
Harold H. Demarest, Jr. *In* Univ. Space Res. Assoc. High Pressure Phys. and Planetary Interiors 1972 p 146-153 refs (For availability see N74-11621 02-30)
(Grant AF-AFOSR-2093-71)
(Publ-1087) Copyright. CSCL 20M

N74-11670* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LASER INITIATED EXPLOSIVE DEVICE SYSTEM
L. C. Yang, V. J. Menichelli, and J. E. Earnest *In* NASA. Langley Res. Center The 8th Aerospace Mech. Symp. Oct. 1973 p 25-35 refs (For availability see N74-11667 02-31)
(Contract NAS7-100)
CSCL 22B

N74-11683* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF LOW-SHOCK PYROTECHNIC SEPARATION NUTS
Laurence J. Bement and Vernon H. Neubert (Pennsylvania State Univ.) *In its* The 8th Aerospace Mech. Symp. Oct. 1973 p 179-212 (For availability see N74-11667 02-31)
CSCL 22B

N74-11744* Old Dominion Univ., Norfolk, Va.
THE ENERGY SITUATION
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 1-48 refs (For availability see N74-11743 02-34)
CSCL 05A

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-11742*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
APPROACH TO RAPID MISSION DESIGN AND PLANNING
W. G. Green and V. J. Matthys Apr. 1973 47 p refs
(Contract NAS8-26578)
(NASA-CR-124252; LMSC-HREC-TR-D306575; HREC-6578-2) Avail: NTIS HC $4.50 CSCL 22A

Methods and techniques are described for implementation in automated computer systems to assess parametric data, capabilities, requirements and constraints for planning earth orbit missions. Mission planning and design procedures are defined using two types of typical missions as examples. These missions were the high energy Astronomical Observatory Satellite missions, and Small Applications Technology Satellite missions. F.O.S.

N74-11743*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering.
THE ENERGY DILEMMA AND ITS IMPACT ON AIR TRANSPORTATION
Calvin R. Dyer, ed., Michael Z. Sincoff, ed., and Paul D. Cribbins, ed. 1973 171 p refs
(Grant NGT-47-003-028)
(NASA-CR-135993) Avail: NTIS HC $10.75 CSCL 05A

The dimensions of the energy situation are discussed in relation to air travel. Energy conservation, fuel consumption, and combustion efficiency are examined, as well as the proposal for subsonic aircraft using hydrogen fuel. For individual titles, see N74-11744 through N74-11748.

N74-11744* Old Dominion Univ., Norfolk, Va.
THE ENERGY SITUATION c33
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 1-48 refs (For availability see N74-11743 02-34)
CSCL 05A

Energy reserves from the principal energy sources other than petroleum and natural gas are summarized. It was found that energy sources are being consumed at rates which exceed the ability to replace them through new discoveries and technology improvements. The costs and implications to environment for using coal and nuclear energy are discussed. Tables are presented on energy consumption, cost of reclamation, and water power capacity. J.A.M.

N74-11745* Old Dominion Univ., Norfolk, Va.
THE AIR TRANSPORTATION/ENERGY SYSTEM
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 49-70 refs (For availability see N74-11743 02-34)
CSCL 05A

The changing pattern of transportation is discussed, and the energy intensiveness of various modes of transportation is also analyzed. Sociopsychological data affecting why people travel by air are presented, along with governmental regulation and air transportation economics. The aviation user tax structure is shown in tabular form. J.A.M.

N74-11746* Old Dominion Univ., Norfolk, Va.
ENERGY CONSERVATION AND AIR TRANSPORTATION
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 71-94 refs (For availability see N74-11743 02-34)
CSCL 05A

Air transportation demand and passenger energy demand are discussed, in relation to energy conservation. Alternatives to air travel are reviewed, along with airline advertising and ticket pricing. Cargo energy demand and airline systems efficiency are also examined, as well as fuel conservation techniques. Maximum efficiency of passenger aircraft, from B-747 to V/STOL to British Concorde, is compared. J.A.M.

N74-11747* Old Dominion Univ., Norfolk, Va.
AN INITIAL STEP: A DEMONSTRATION PROJECT
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 95-117 refs (For availability see N74-11743 02-34)
CSCL 05A

To initiate the transition into a clean and diverse energy environment independent of fossil-based fuels, the rapid development of a subsonic, hydrogen-fueled aircraft is recommended.

Tables are presented on characteristics of synthetic fuels, comparisions with JP-4 and gasoline, comparison of nitric oxide emissions from hydrocarbon and hydrogen fuels vs. final flame temperature, and sensitivity limits of LH2 detectors. J.A.M.

N74-11748* Old Dominion Univ., Norfolk, Va.
CONCLUSIONS AND RECOMMENDATIONS
In its The Energy Dilemma and Its Impact on Air Transportation 1973 p 119-173 refs (For availability see N74-11743 02-34) CSCL 05A

Conclusions and recommendations are presented for an analysis of the total energy situation; the effect of the energy problem on air transportation; and hydrogen fuel for aircraft. Properties and production costs of fuels, future prediction for energy and transportation, and economic aspects of hydrogen production are appended. J.A.M.

N74-11749# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF TENDENCIES AND FORECAST OF SCIENTIFIC-TECHNICAL PROGRESS
30 Oct. 1973 353 p refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1966 Presented at the 1st All Union Symp. on the Appl. of Math. Methods and Computer Technl. in Studies of the History of Sci.-Technol. Progr., Kiev, 1966
(JPRS-60402) Avail: NTIS HC $19.75

The proceedings of a symposium on the application of mathematical methods and computer technology in studies of the history of scientific and technical progress are presented. The information is intended for persons engaged in the analysis of the directions and levels of scientific and technological development, for workers of the information-patent services, and for historians of natural science and technology. Some of the subjects discussed are: (1) comparative analysis with the aid of computers, (2) engineering and technical importance of inventions, (3) methods of technological forecasting, (4) methods of evaluation effectiveness of scientological analysis, and (5) computer processing of historical materials. For individual titles, see N74-11750 through N74-11782.

N74-11750 Joint Publications Research Service, Arlington, Va.
APPLICATION OF MATHEMATICAL METHODS AND COMPUTER TECHNOLOGY FOR ANALYSIS OF TRENDS AND FORECASTING OF SCIENTIFIC-TECHNOLOGICAL PROGRESS c19
G. M. Dobrov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 1-18 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 5-19 (For availability see N74-11749 02-34)

The problems of the history of scientific and technological progress that are being investigated with the aid of new methods are discussed. The associations with other fields such as, natural, industrial, and social sciences, scientific and technological information, patent services, and agencies managing the development of science and technology are described. The updating of problematics is the objective law of the development of the history of natural science and technology. Scientific and industrial progress as a whole and each of its specific manifestations embody the past, present, and future. Historical methodology is considered to be the indispendable prerequisite for the scientific approach to analysis of the problems of scientific and industrial progress. Author

N74-11751 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE UTILIZATION OF THE ELECTRONIC DIGITAL COMPUTER FOR HISTORICAL-TECHNOLOGICAL ANALYSIS OF SPECIFIC FORMS OF TECHNOLOGY (THE EXAMPLE OF COAL MINING COMBINES) c08
L. P. Smirnov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 19-33 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 23-37 (For availability see N74-11749 02-34)

The use of electronic computers for solving series of problems of information retrieval and information logic analysis pertaining to the coal mining industry is discussed. A form of analysis, called the rejected application library on coal mining combines, for historical-technological studies is described. On the basis of analysis of existing coding methods an effective method of recording information about coal mining combines is selected, which makes it possible to solve problems of information retrieval for statistical and logical analysis. Author

N74-11752 Joint Publications Research Service, Arlington, Va.
WORLD TECHNOLOGICAL LEVEL AND HOW IT IS DETERMINED
I. D. Ivanov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 34-39 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 38-43 (For availability see N74-11749 02-34)

The determination of the level of industrial technology on the basis of information obtained from industrial and technical-economic literature, retrospective patent library, standards, specifications, advertisements, and catalogs is discussed. It is characterized by the technical-economic parameters of the newest mass produced products, well received by the market, and also of the latest technology successfully adopted by leading enterprises. This level may be used for comparative analysis of Soviet products, the technology employed or adopted, and also of imported products or technology for the purpose of determining how progressive they are. Author

N74-11753 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE TREND OF DEVELOPMENT OF SPECIFIC FORMS OF TECHNOLOGY ON THE BASIS OF PATENT SOURCES
Ye. I. Levin and Yu. V. Yershov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 40-49 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 44-54 (For availability see N74-11749 02-34)

The history of development of certain Soviet design decision related to coal mining is presented. The character of change of the number of applications of design decisions concerning combined coal mining machines, with emphasis on certain types of machines, is analyzed. The mechanization of data processing for the purpose of analyzing technological data is discussed. The importance of combined qualitative and quantitative analysis of patent information, the possibilities for multi-aspective analysis, and adoption of computer methods for historical-scientific data is defined. Author

N74-11754 Joint Publications Research Service, Arlington, Va.
ON THE POSSIBILITY OF COMPARATIVE ANALYSIS WITH THE AID OF THE COMPUTER c08
E. F. Skorokhodko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 50-54 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 55-59 (For availability see N74-11749 02-34)

The Institute of Cybernetics of the Academy of Science of the Ukrainian SSR has developed several algorithms intended for the solution of certain problems related to analysis and processing of information written in natural languages, in particular for information retrieval. Some of these algorithms may be important for specialists engaged in the development of methods of historical-technological and patent analysis using electronic digital computers. A tool for comparative analysis for the purpose of determining identical and different indices may be constructed on the basis of these algorithms. Author

N74-11755 Joint Publications Research Service, Arlington, Va.
THE ENGINEERING-TECHNICAL IMPORTANCE OF INVENTIONS
V. G. Gmoshinskiy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 55-68 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 60-71 (For availability see N74-11749 02-34)

Methods for conducting engineering-technical evaluations of the retrospective patent library, its systematization according to engineering-technical indices, and the ongoing search for required solutions are presented. The problem of developing criteria for evaluating the technical significance and the promise of each patent individually and of groups of patents that comprise a given branch of classification of patent solutions is analyzed. Numerical methods for determining the engineering-technical significance of inventions are developed. Author

N74-11756 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF TECHNOLOGICAL DEVELOPMENT ACCORDING TO PATENT MATERIALS
I. Yu. Zborovskiy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 69-78 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 72-81 (For availability see N74-11749 02-34)

The analysis of inventions and patents as a method for determining the technological level of a country is proposed. The characteristics of patents which make this a valid method are described. Analysis of patents and inventions also provides an indication of the trends of technological development. Various types of industry are examined on the basis of pertinent inventions to support the claim for technology evaluation accuracy. Author

N74-11757 Joint Publications Research Service, Arlington, Va.
TABULATION OF PATENT DESCRIPTIONS AS A MEANS OF INVESTIGATING THE TRENDS OF SCIENTIFIC-TECHNOLOGICAL PROGRESS
B. N. Tardov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 79-99 ref Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 82-100 (For availability see N74-11749 02-34)

A numerical method for determining the trends of development of scientific-technical progress is proposed. The method is based on the law of accelerated development of science and is founded on classification analysis of the qualitative-quantitative dynamics of patent transactions in the leading industrial countries of the world. The requirements which must be met by any information to be included in the sum of knowledge are described. It is stated that patents meet the specific requirements for the purpose of technology evaluation. Author

N74-11758 Joint Publications Research Service, Arlington, Va.
ON THE POSITION AND IMPORTANCE OF STANDARDS IN INVESTIGATIONS OF THE HISTORY OF SCIENTIFIC-TECHNOLOGICAL PROGRESS
B. M. Orlov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 100-104 ref Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 101-105 (For availability see N74-11749 02-34)

The significance of standardization and its importance as a means of implementing USSR national politics concerning product quality and competitiveness on the world market is described, and the development of an automated information retrieval system for documents and materials collected in libraries is projected. Considered are: (1) Data collection and scientific processing of specific facts concerning standardization information; (2) quantitative analyses for development of standardization trends; (3) special studies pertaining to standardization in scientific technological progress; (4) determination of the relationship of the standard with science and practical application; (5) effect of standardization on economic and social developments; and (6) determination of significance criteria for various standard data. It is shown that standards are best constructed by arranging their indices in order of increasing importance. G.G.

N74-11759 Joint Publications Research Service, Arlington, Va.
TRENDS IN THE MECHANIZATION OF THE COAL INDUSTRY AND GUARANTEE OF PATENT-ABILITY OF DESIGNS THAT ARE COMPETITIVE ON THE WORLD TECHNOLOGICAL LEVEL
V. L. Shteynbuk *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 105-112 ref Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 106-113 (For availability see N74-11749 02-34)

An analysis of the historical trends in the development of mechanized hydraulic supports for the USSR coal industry is given; the relationships to problems of legal protection, patenting, patent purity, and future requirements in worldwide competition are discussed. It is proposed that computerized analysis of historical and technical experience is included in the processing of technological inventions pertaining to mechanized hydraulic supports. G.G.

N74-11760 Joint Publications Research Service, Arlington, Va.
THE HISTORY OF TECHNOLOGY AND ENGINEERING SOLUTIONS
O. F. Schukin *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 113-114 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 114-115 (For availability see N74-11749 02-34)

Mathematical methods and computer processing of accumulated technological and engineering data are essential in forecasting the development and operation of modern coal mines. The blueprint for construction of a modern coal mine should include considerations of technological progress and economic aspects in planning and design organization. G.G.

N74-11761 Joint Publications Research Service, Arlington, Va.
ON SOME METHODS OF TECHNOLOGICAL FORECASTING
Ye. S. Zharikov and V. A. Lisichkin *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 115-125 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 116-126 (For availability see N74-11749 02-34)

The best of forecasting technology are the following three: (1) Analysis of patents, (2) analysis of the promises of scientific research work; and (3)construction of economic-mathematical models of industrial development. It is concluded that the very process of forecasting industrial development can hardly be effective without the combined use of these methods. Author

N74-11762 Joint Publications Research Service, Arlington, Va.
HISTORICAL EXPERIENCE IN THE DEVELOPMENT OF MECHANIZED DOCUMENTAL INFORMATION SYSTEMS **c08**
K. B. Gelman-Vinogradov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 126-130 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Progressa" Kiev, Naukova Dumka, 1967 p 127-131 (For availability see N74-11749 02-34)

Automatic document processing methods in the USSR are reviewed from the first semi-automatic data retrieval system that used a 22-column punch card, coded in double period monitor/perforator, up to the development of computerized reading machines that process stylized printed digital symbols. G.G.

N74-11763 Joint Publications Research Service, Arlington, Va.
INFORMATION RETRIEVAL SYSTEM FOR FINDING AND PROCESSING INFORMATION IN PLANNING ORGANIZATIONS **c08**
L. G. Kazhdan *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 131-137 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 132-137 (For availability see N74-11749 02-34)

The importance of documentation, compiled as a result of the activity of planning organizations, for the adoption of scientific and technological achievements in the national economy is emphasized. Computerized information retrieval systems are essential for processing planning documentation data to insure mandatory utilization of stored technical information about the level of industrial development, the socio-economic structure of society, and the history of industry and technology. G.G.

N74-11764 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE UTILIZATION OF EDGE PUNCH CARDS AND VISUAL CARDS IN REFERENCE INFORMATION WORK c08
M. M. Marchevskiy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 138-140 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 138-140 (For availability see N74-11749 02-34)

The number of cards in a library, the number of requests for retrieval, and the cost of the given system determine the use of either edge punch cards or visual type punch cards in scientific technical data processing systems. Edge punch cards are suitable for files with up to 50,000 cards and search requests of 200 and more per day. Visual punch cards of the photographic descriptor type are processed by sorting boxes and coding needles and do not require an ordering library system. Both, two row edge cards and visual cards can be used in scientific research and planning institutes, as well as in hospitals, polyclinics, personnel departments, etc. G.G.

N74-11765 Joint Publications Research Service, Arlington, Va.
FORECASTING OF TECHNOLOGICAL PROGRESS FOR LONG-RANGE PLANNING OF MINING OPERATIONS AT COAL MINES
A. M. Arabadzhev, G. M. Dobrov, N. I. Ivanov, and L. P. Smirnov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 141-148 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 141-148 (For availability see N74-11749 02-34)

Ideas, principles, and decisions that result from scientific-technical research are included in forecasting the development of coal field reserves and planning for coal mine operations. The process of mine development planning is represented as a multistage industrial process, distributed in time and space, where specific loads are increased by improved technology and operational organization to yield practical conclusions. An algorithm is developed that solves the feasibility problem of converting from one qualitative state (old equipment) to a new one, corresponding to the decision to replace the old equipment which has exhausted its technical and economic capabilities. G.G.

N74-11766 Joint Publications Research Service, Arlington, Va.
CODING OF COMPANY NAMES c08
B. N. Tardov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 149-155 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 149-154 (For availability see N74-11749 02-34)

Computer retrieval and analysis of patent descriptions relevant to company names requires that the numerical code of the firm be the same for all tabulagrams. It is proposed that the first letters of the main words of a company's name are translated into a number for coding. A number code that denotes an abbreviated company name is found by formulating a spectral composition of letters that includes the number of symbols, the letters, the frequency of appearance of a letter at the beginning of the word, actual integral probability, and integral probability in the uniform spectrum. A formula is developed that allows for numerical coding of company names by simple addition of not more than six letters in about 15 seconds by computer. G.G.

N74-11767 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN THE SOLUTION OF SOME PROBLEMS OF GENERAL SCIENTOLOGY USING COMPUTER TECHNOLOGY c08
G. M. Dobrov and V. N. Klimenyuk *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 156-176 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 157-177 (For availability see N74-11749 02-34)

An analysis is presented of the trends in the growth and changes in the staffs of the scientific community for the Soviet Union. The age structure of scientific personnel, the changes in the proportion/of new doctor candidates of science in basic fields of science, and trends in dissertations are discussed. F.O.S.

N74-11768 Joint Publications Research Service, Arlington, Va.
NETWORK SCHEDULE AS A MEANS OF QUANTITATIVE ANALYSIS OF THE COURSE OF SCIENTIFIC-TECHNICAL DEVELOPMENTS
G. A. Lakhtin *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 177-183 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 178-184 (For availability see N74-11749 02-34)

The network schedule is examined as a basic tool for analyzing the evolution of scientific-technological progress. The principles of the network schedule, the logical elements of operations and events, the analysis of delays, and the determination of costs are discussed. F.O.S.

N74-11769 Joint Publications Research Service, Arlington, Va.
SCIENTIFIC INFORMATION IN THE PROCESS OF DEVELOPMENT AND INTERACTION OF SCIENCES
S. Ye. Zlochevskiy and A. V. Kozenko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 184-195 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 185-196 (For availability see N74-11749 02-34)

The representation of scientific information as a vector in a semantic space is discussed in terms of the relationships of data. Categories of the relationship of data are described. Spheres of semantic completeness of individual sciences are considered along with the transformation of a set of knowledge into a science. The development of new sciences from the interaction of several sciences is also considered. F.O.S.

N74-11770 Joint Publications Research Service, Arlington, Va.
SPECIFIC-SOCIOLOGICAL INVESTIGATION OF THE ORGANIZATION OF SCIENTIFIC LABOR
I. V. Chernov and A. I. Shcherbakov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 196-209 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 197-210 (For availability see N74-11749 02-34)

The systematic organization of the labor of scientists is analyzed for industry in a communistic system. The problems studied include: the scientist's choice of profession, determination of the subject for investigations, applications of research results, and resolving conflicts in research institutions. F.O.S.

N74-11771 Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS OF COMPUTER PROCESSING OF HISTORICAL MATERIALS OF POLYTHEMATIC LIBRARIES
M. Shvankmayer *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 210-214 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 210-214 (For availability see N74-11749 02-34)

An investigation of the problems in the application of modern technology to historical studies in Czechoslovakia is reported. Polythematic library is defined as a collection of documents of previously known character which have different content, not previously known. An analysis of the retrieval of information from a historical polythematic library is presented. F.O.S.

N74-11772 Joint Publications Research Service, Arlington, Va.
LOGIC MEANS OF FILTERING INFORMATION IN SCIENTIFIC RESEARCH
V. V. Kosolapov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 215-225 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 215-226 (For availability see N74-11749 02-34)

The problem of forecasting scientific discoveries is dealt with. It is theorized that, if unknown phenomena can be predicted on the basis of what is already known, then there are obviously

logical rules for changing from the known to the unknown and forecasts become possible. The development of logical multivariant programs for systematizing the creative process and calculating some optimal rules for scientific forecasting of possible discoveries is proposed. Various methods are discussed for analyzing experimental research results with consideration of the filtering phenomena of logical means on information obtained from the experiment. It is concluded that the factor ranking method should be supplemented by objective methods of seeking anomalies between research results and its presumed hypothetical explanations. D.L.G.

N74-11773 Joint Publications Research Service, Arlington, Va.
CERTAIN PROBABILITY CHARACTERISTICS OF FORECASTING SCIENTIFIC-TECHNOLOGICAL CREATIVITY
A. V. Kozenko and S. Ye. Zlochevskiy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 226-233 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 227-234 (For availability see N74-11749 02-34)

It is proposed that, conclusions concerning the possibility of recurrence of phenomena of the probability of the state of a given system may be derived on the basis of: causal relations and stable trends, investigation of analogous situations of the past, or by using the theory of probability. It is pointed out that the creative activity of scientific workers can be judged to a considerable extent on the basis of the load on information systems and the frequency of reference to them. It is then concluded that by using time tested methods of queuing theory it is possible to described mathematically certain phenomena and, on this basis, to calculate the load on the system as a whole and to determine the probable demand for a given form of information. By utilization of the obtained indirect indices, it becomes possible to forecast the intensity of scientific creativity. D.L.G.

N74-11774 Joint Publications Research Service, Arlington, Va.
ON THE APPLICATION OF QUANTITATIVE METHODS IN STUDIES OF THE HISTORY OF MATHEMATICS c19
L. Novyy and Ya. Folta *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 234-260 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 235-262 (For availability see N74-11749 02-34)

Information is presented to show how quantitative analysis of large sets of facts can facilitate the development of methodological tools in the history of mathematics. Three areas are discussed: (1) the character of certain indices of the general development of mathematics, (2) the application of simple tools for investigating the possibilities of detailed analysis of the development of sets of narrower mathematical disciplines, and (3) the utilization of analogous tools for investigating the development of scientific activity of mathematicians. D.L.G.

N74-11775 Joint Publications Research Service, Arlington, Va.
EXPERIENCE AND UTILIZATION OF COMPUTER TECHNOLOGY AT THE INSTITUTE OF HISTORY ACADEMY OF SCIENCES ESTONIAN SSR AND SOME PROSPECTS OF FUTURE DEVELOPMENT OF THESE WORKS c08
Kh. E. Palli *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 261-266 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova dumka, 1967 p 261-266 (For availability see N74-11749 02-34)

The use of computer technology and techniques to reconstruct and retrieve historical data is discussed. Data are processed according to several mathematical models: correlation coefficients and coefficients of control and correlation and factor matrices. E.H.W.

N74-11776 Joint Publications Research Service, Arlington, Va.
HISTORICAL STRUCTURE CARDS: BASIS FOR SYSTEMATIZATION IN STUDIES OF THE HISTORY OF SCIENTIFIC-TECHNOLOGICAL PROGRESS
Yu. I. Rylev *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 267-276 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 269-278 (For availability see N74-11749 02-34)

The feasibility of developing a universal systematization, embracing all fields of human knowledge is examined. Data cover principles, description, and purpose of the historical structure card system. The use of the system as a retrieval, research, and dialectical teaching method is discussed. E.H.W.

N74-11777 Joint Publications Research Service, Arlington, Va.
METHODS OF EVALUATING EFFECTIVENESS OF SCIENTOLOGICAL ANALYSIS
V. V. Borisov, M. K. Luchnik, and A. A. Savelyev *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 277-284 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 279-286 (For availability see N74-11749 02-34)

Attempts were made to determine the effectiveness of scientific activity in relation to individual productivity and creativity. The resulting data are used to facilitate rational financing and performance evaluation of scientific group. E.H.W.

N74-11778 Joint Publications Research Service, Arlington, Va.
ON A MODEL OF CHANGES IN THE LEVEL OF THE RELATIVE CLASSIFICATION OF SCIENTISTS
A. A. Korennoy *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 285-292 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 287-294 (For availability see N74-11749 02-34)

Formal, logical, and mathematical models, used to analyze changes in the classification of scientists, are presented. The changes include capabilities, potential capabilities, qualifications, and productivity. Time required to solve problems without increasing manpower and materials resources is also included. E.H.W.

N74-11779 Joint Publications Research Service, Arlington, Va.
ON THE CRITERIA FOR THE CHOICE AND MEANS OF DEVELOPMENT OF MECHANIZED DATA RETRIEVAL SYSTEMS FOR STATE ARCHIVES c08
L. G. Khromchenko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 293-305 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 295-305 (For availability see N74-11749 02-34)

The use of cybernetic technology to model an information processing and retrieval system suitable for use by the U.S.S.R. state archives is examined. A punch card system was studied experimentally and found to be a feasible method of solving archives information service problems. E.H.W.

N74-11780 Joint Publications Research Service, Arlington, Va.
ON CYBERNETICAL MODELING IN INVESTIGATIONS OF THE GENERAL HISTORY OF SCIENCE AND TECHNOLOGY
G. A. Yeremenko *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 306-317 Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 306-317 (For availability see N74-11749 02-34)

The methodological problems that are encountered in attempts to construct qualitative and quantitative models of evaluation of science and technology as a whole are discussed. Author

N74-11781 Joint Publications Research Service, Arlington, Va.
CHRONOLOGICAL SPECTRA
Ye. D. Grazhdannikov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 318-329 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 318-328 (For availability see N74-11749 02-34)

The construction and mathematical processing of chronological spectra as a method of objective quantitative analysis of

historical and scientific data are discussed. It was established that a periodicity and geometric progression occurs in scientific and historical processes. E.H.W.

N74-11782 Joint Publications Research Service, Arlington, Va.
TYPOLOGY OF FORECASTS AND ANALYSIS OF DELPHI METHOD
G. M. Dobrov *In its* Anal. of Tendencies and Forecast of Sci.-Tech. Progr. (JPRS-60402) 30 Oct. 1973 p 330-342 refs Transl. into ENGLISH of the book "Analiz Tendentsiy i Prognozirovaniye Nauchno-Tekhnicheskogo Progressa" Kiev, Naukova Dumka, 1967 p 329-340 (For availability see N74-11749 02-34)

An attempt was made to characterize seven types of long term scientific forecasts as a function of the methodological approaches to their development. A comparative analysis was made of forecasts obtained by the Delphi method with those obtained by other methods. It was concluded that a combined approach is needed to forecast long term scientific and historical development. E.H.W.

N74-11783*# Linguistic Systems, Inc., Cambridge, Mass.
FUTURE ASPECT OF ANALYTICS: MODERN FOUNDATIONS AND GOALS
G. Gottschalk Washington NASA Nov. 1973 24 p refs TRansl. into ENGLISH from Z. Anal. Chem. (West Berlin), v. 258, 1972 p 1-12
(Contract NASw-2482)
(NASA-TT-F-15030) Avail: NTIS HC $3.25 CSCL 09D

A definition of modern analytics was given which explained the determination of quality, quantity, and state of components in materials as limited tactical questions within a superimposed strategy for an optimal gain and utilization of information on the state and processes in material systems. The basic principles of system theory, theory of games, and information theory were outlined and interpreted from the view of analytics. Author

N74-11784*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FOUR CITIES: HIGH TECHNOLOGY FACES URBAN PROBLEMS Interim Report
James H. Wilson and Harold L. Macomber 14 Sep. 1973 30 p refs Sponsored by NSF
(Contract NAS7-100)
(NASA-CR-136008; JPL-1200-100) Avail: NTIS HC $3.50 CSCL 05K

The Four Cities Program, a pilot demonstration of a new whole-system approach to technology transfer, is discussed. The transfer link, between aerospace engineering and city management, is accomplished directly by pairing a corporation with each of four California cities, assigning a senior staff member as science and technology advisor to each City Manager. Most significant transfers have been in project management and system analysis techniques, though acquisition of new hardware and software has also resulted from the program. Fostering of inter-institutional communications and understanding has been a major outcome of the effort. Author

N74-11785# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 311
26 Oct. 1973 66 p refs Transl. into ENGLISH from various Russian articles
(JPRS-60375) Avail: NTIS HC $5.50

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-11786# Joint Publications Research Service, Arlington, Va.
THE STYLE OF SCIENCE, ITS SYNTHESIS, AND PROBLEMS IN THE PLANNING OF SCIENTIFIC PROGRESS
B. G. Kuznetsov 31 Oct. 1973 15 p Transl. into ENGLISH from Priroda (Moscow), no. 4, 1973 p 38-43
(JPRS-60426) Avail: NTIS HC $3.00

The style is presented of science, its synthesis, and problems in the planning of scientific progress. Author

N74-11787# Committee on Science and Astronautics (U. S. House).
SOLAR-ENERGY FOR HEATING AND COOLING
Washington GPO 1973 295 p refs Hearings before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 13, 7 and 12 Jun. 1973
Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the use of solar energy for heating and cooling. Examples of various solar energy conversion systems are illustrated and described. The subjects discussed are: (1) the status of solar energy technology, (2) market factors, (3) technology transfer, and (4) the benefits of using solar energy for heating and cooling buildings. P.N.F.

N74-11788# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT: AN OVERVIEW OF OUR NATIONAL EFFORT
Washington GPO 1973 51 p Hearing before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 10, 15 May 1973
Avail: Subcomm. on Energy

A Congressional hearing was conducted to discuss the research and development efforts directed toward providing sources of energy. The funds available for research and development by government and private agencies are presented. The various alternate sources of energy are described to show the level of effort for each source. The long range priorities which involve the development of new energy sources and the conservation of energy are analyzed. Examples of alternate energy sources are included to show specific techniques for energy conversion. P.N.F.

N74-11789# RAND Corp., Santa Monica, Calif.
DOCUMENTATION: AN OVERVIEW AND DESIGN STRATEGY
Garry D. Brewer Jul. 1973 14 p
(P-5052) Avail: NTIS HC $3.00

Design strategy for large scale documentation systems is reviewed. Various classes of information, related forms of documentation, and functions performed in a decidedly user oriented environment were considered. The importance of information dissemination was stressed: not all participants want to know everything all of the time, and some principles of selectivity must be invoked. Author

N74-11790# RAND Corp., Santa Monica, Calif.
ENERGY DEMAND AND ITS EFFECT ON THE ENVIRONMENT
D. N. Morris Jul. 1973 28 p
(P-5048) Avail: NTIS HC $3.50

An analysis of the current energy crisis and the possible environmental factors involved in the use of alternate sources of energy to reduce the consumption of fossile fuels is presented. Graphs are developed to show: (1) energy use in the United States, (2) total U.S. crude oil production from 1860 to 2060, (2) consumption of electricity in California, and (4) commercial, residential, and industrial electrical use in California. Measures for conserving electricity are proposed. The estimated national air pollution emission by source in 1969 is shown in table form. Author

N74-11791# RAND Corp., Santa Monica, Calif.
ENERGY TRENDS AND THEIR FUTURE EFFECTS UPON TRANSPORTATION
W. E. Mooz Jul. 1973 27 p refs
(P-5046) Avail: NTIS HC $3.50

The impact of fuel shortages on the transportation energy is discussed. The areas investigated are: (1) the demand for energy for transportation purposes, (2) the supply of energy for transportation purposes, and (3) the espected price of energy. Graphs are included to show the overall energy requirements, comparative energy intensiveness values for different methods of transportation, recent trends in automobile fuel use, a history of rail, truck, and air cargo development, and an analysis of annual energy consumed by all transport modes in the United States. P.N.F.

N74-11792# Chicago Univ., Ill. Div. of Physical Sciences.
MATERIALS RESEARCH LABORATORY Annual Technical Report, 1 Jul. 1972 - 30 Jun. 1973
15 Aug. 1973 94 p refs
(Grant NSF GH-33636)
(AD-766611; ATR-1) Avail: NTIS CSCL 05/2

This is the first Annual Technical Report of the Materials Research Laboratory at the University of Chicago. The projects covered the following topics: Solid state and low temperature physics; Properties of amorphous materials; Dynamics of energetic species; Organic and inorganic materials; Materials at high temperatures or pressures; and Surface properties. GRA

N74-11793# California Univ., La Jolla. Inst. for Pure and Applied Physical Sciences.
RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS Semiannual Technical Status Report, 1 Oct. 1972 - 31 Mar. 1973
S. C. Lin 31 Mar. 1973 36 p
(Contract DAHC04-72-C-0037; ARPA Order 570)
(AD-766347) Avail: NTIS CSCL 20/4

The research, with primary emphasis on the physics of turbulent flow, plasmas and lasers, includes: (1) Wake turbulence and atmospheric boundary layers, (2) turbulent mixing and shear flows, (3) high-temperature gas dynamics, (4) ionospheric physics, (5) laser propagation and advanced technology, and (6) laser diagnostics and interactions. GRA

N74-11794# Army Construction Engineering Research Lab., Champaign, Ill.
CONSTRUCTION TIME OVERRUNS
D. W. Halpin and R. D. Neathammer Aug. 1973 78 p
(DA Proj. 4DM-78012-A-OK1)
(AD-766725; CERL-TR-P-16) Avail: NTIS CSCL 15/5

The actual time required to complete construction on military facilities is often greater than the time contractually specified. There are several reasons for these overruns or time extensions: designer changes/errors, user changes, weather, strikes, late deliveries, etc. These time extensions were studied by examining a sample of contracts throughout CONUS from the time period July 1967 - June 1970. Based on the 221 contracts evaluated it is estimated that for an average contract, an additional 27% of the specified construction time will be allowed as time extensions. Author (GRA)

N74-11795# InterTechnology Corp., Warrenton, Va.
THE U.S. ENERGY PROBLEM. VOLUME 2: APPENDICES, PART A Final Report, Dec. 1970 - Nov. 1971
G. C. Szego 1971 745 p refs 2 Vol.
(Grant NSF C-645)
(PB-207518; NSF-RANN-71-1-2) Avail: NTIS HC $12.50 CSCL 10B

The energy status and outlook for the United States and the World are analyzed. A simulation model of fossil fuel steam electric generating plants is developed. The model includes the following features: (1) cost tradeoff analysis, (2) influence coefficients, (3) cost reduction versus technology, (4) cost of fossile fuels, (5) magnetohydrodynamic topping, (6) nuclear energy, (7) residential energy analysis, and (8) solar energy. Author

N74-11796# InterTechnology Corp., Warrenton, Va.
THE U.S. ENERGY PROBLEM. VOLUME 2: APPENDICES, PART B Final Report, Dec. 1970 - Nov. 1971
G. C. Szego Nov. 1971 686 p refs 2 Vol.
(Grant NSF C-645)
(PB-207519; NSF-RANN-71-1-3) Avail: NTIS HC $12.50 CSCL 10B

An analysis of the energy requirements and energy sources for the United States is presented. The subjects discussed are: (1) off-peak storage, (2) state of electrochemical research and development of fuel cells, (3) alternate energy conversion cycles, (3) effects of failures of cryogenic superconductivity on electrical transmission lines, (4) transportation requirements, (5) environmental factors, (6) future investment capital for public utilities, (7) supply and demand analysis for energy related minerals, (8) econometric model for primary industries, (9) technology of alternate fuels, (10) a petroleum refinery model, and (11) the current state of thermionic energy conversion technology. Author

N74-11797*# Korean Inst. of Science and Technology, Seoul.
AID/NASA PILOT PROJECT FOR TECHNOLOGY TRANSFER TO A DEVELOPING NATION. REPUBLIC OF KOREA Final Report
Jun. 1972 191 p refs Sponsored in part by NASA
(Grant PASA-TA(ZA)-7-70)
(NASA-CR-136076; PB-222557/1; CK-17-326) Avail: NTIS HC $11.75 CSCL 05A

The Korea Institute of Science and Technology presents the report as evaluation of an international technology transfer program from the viewpoint of a recipient nation. The program was a pilot study to determine the feasibility of and to establish refined techniques for the transfer of aerospace-developed technology to developing nations. GRA

N74-11798# Korean Inst. of Science and Technology, Seoul.
PROCEEDINGS OF THE INTERNATIONAL SEMINAR ON DISSEMINATION OF TECHNOLOGY
Nov. 1972 159 p refs Seminar held at Seoul, 20-22 Nov. 1972 Prepared in part by Illinois Inst. of Tech.
(Contract PASA-TA(ZA)-7-70)
(PB-222954/0) Avail: NTIS HC $4.75 CSCL 05A

The purpose of the seminar was to share among developing countries the experiences of both the Korea Institute of Science and Technology and the Illinois Institute of Technology Research Institute that acted as the technology transfer agents in relation to NASA developed technologies. Further, the seminar was intended to provide a forum for a free and open exchange of views among the participants who represented the industries, research institutions, and governments of seven Asian nations and the United States. The report includes a summary of recommendations of the panel discussions. GRA

N74-11799# George Washington Univ., Washington, D.C.
FEDERAL TECHNOLOGY TRANSFER
Todd Anuskiewicz Aug. 1973 73 p refs Sponsored by NSF, NTIS, NOL and Am. Univ., Washington, D. C.
(PB-222483/0) Avail: NTIS HC $3.75 CSCL 05A

A survey is presented of current Federal technology transfer and research utilization activities, designed to provide a data-base for a 1973 colloquium on technology transfer sponsored by American University, NTIS and the Navy. Material from eighteen Federal programs with readily identifiable technology transfer or research utilization activities is included. GRA

N74-11800# Boeing Co., Seattle, Wash.
TECHNOLOGY TRANSFER IN TACOMA, WASHINGTON. THE TOTEM ONE PROGRAM
William V. Donaldson, A. Frederick Fath, Harvey R. Singleton, and C. Ray Turner Jul. 1973 16 p Presented nd at the 2nd AIAA Urban Technol. Conf., San Francisco, Calif., 24-26 Jul. 1972
(Contract NSF GT-34903)
(PB-222515/9) Avail: NTIS HC $3.00 CSCL 05D

The process by which aerospace technology can be understood and used by city personnel is being tested through the Totem One Technology Transfer Program in Tacoma, Washington. The purposes of bringing aerospace technologists to Tacoma are to determine if aerospace technology can be applied to attain productivity gains in the delivery of municipal services and to find out what techniques can be used which foster the understanding and use of technology in the operation of municipal government. The process report covers results in transit, fire service, and planning departments in the city of Tacoma, with discussions on effectiveness of technology transfer techniques and descriptions of specific applications of technology. GRA

N74-11801# City of Tacoma, City Manager's Office, Wash.
PROJECT/COST/BENEFIT Summary Report, 1st Half of 1972
Harvey R. Singleton Jan. 1973 33 p
(Contract NSF GT-34903)
(PB-222339/4) Avail: NTIS Hc $3.75 CSCL 13B

The report is a listing of the projects with their cost and benefits, carried out under Tacoma's Totem One Program for

1972. The program is a technology transfer experiment utilizing a consortium of industrial and university talent, with city personnel. It uses an actual problem solving approach to build institutional capacity to integrate technological innovations systematically. GRA

N74-11802# City of Tacoma, City Manager's Office, Wash.
TOTEM ONE PROGRAM Interim Report, Jul. - Dec. 1972
Harvey R. Singleton Jan. 1973 24 p
(Grant NSF GT-34903)
(PB-222346/9) Avail: NTIS HC $3.25 CSCL 13B

The report is a first-six-months status report for the Totem One technology transfer program in operation in the city of Tacoma, Washington, designed to record major activities taking place in the program and to outline its accomplished results. Totem One Program is a technology applications program with the objective of improving the productivity of the city in providing services to citizens through the application of technological and management tools. City personnel aer working with aerospace and industrial technologies, and univeristy personnel. GRA

N74-11803# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
AEDC FISCAL YEAR 1974 AIR FORCE TECHNICAL OBJECTIVE DOCUMENT Final Report
Sep. 1973 89 p refs
(AD-766719; AEDC-TR-73-120) Avail: NTIS CSCL 14/2

The report describes eighteen technical objectives in environmental facility simulation technology. The facility technology of concern includes new facility technology improvements in test techniques, instrumentation technology, gas properties and comparison of wind tunnel and flight test data. These technical objectives constitute the Arnold Engineering Development Center's FY 1974 Technical Objectives Document. This document supersedes TOD 71-43. Author (GRA)

N74-11220 United Nations Educational, Scientific and Cultural Organization, Paris (France).
LEGAL PROBLEMS ASSOCIATED WITH UNMANNED OCEAN DATA ACQUISITION SYSTEMS (ODAS)
D. P. D. Scott *In* WMO Means of Acquisition and Commun. of Ocean Data, Vol. 2 1973 p 1-8 refs (For availability see N74-11219 02-13)

N74-11734* Houston Univ., Tex.
SAFETY, LEGAL, ENVIRONMENTAL, ECONOMIC, POLITICAL, AND SOCIAL ASPECTS OF HYDROGEN
In its A Hydrogen Energy Carrier, Vol. 2 Sep. 1973 p 117-146 refs (For availability see N74-11728 02-33)
CSCL 05C